EchoStar / RCA
Satellite Receiver Schematics
30 / Mar / '02
Ver 2.0

Drawn by: MDevries

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Hi guys:

While these schematics are not perfect, they are quite compressive. They are the result of many nights work. Hopefully you find them useful and will support me in the drawing of more.

If you find any errors, and like any first draft I'm sure there are some, you can private message (PM) me at http.://id-discussions.com/vbulletin/index.php

Drawing up schematics of something as complicated as this, is not something you want to do with a working unit as you typically have to rip them apart, which unless you're very lucky, destroys them. Fortunately I had a dead 2700 I purchased on Ebay for $5.00. I would like to post more schematics, so I you know of any other newer DEAD, but complete DishNet or BEV IRDs (receivers) cheap, especially a 4700 or any of the PVR models sans HardDrive, please let me know.

One of the reasons I drew up these schematics was that I had noticed my 2700's PCB was laid out for several unpopulated components. I then developed the theory that the 27/3700 and the 4700 used the SAME PCB . i.e that the only difference between these models was in how the PCB was populated. I still hold this belief, unfortunately I now realize that such an upgrade is virtually impossible. The problem is the 4700 uses a custom IC, or ASIC for; the AC3 Dolby, the optical output, the IR Blaster and the UHF remote. To make things worse the 4700 also uses an obsolete IC for the system clock. As neither of these ICs are commercially available, the upgrade can only be done by using a dead 4700 as a donor. :(

Cheers
M

EchoStar 2/3/4700:

A bit of warning. It appears that there are several PCB versions of the 27/37/4700. As such there may be slight variations between things such as component labels. Also the LBN Tuner and AC3 sections were drawn up without the aid of data sheets and as such I've have no means to cross check these pages, so please be very careful when using these two pages.

EchoStar 3100 / DP301 (with SC2000 processor)**:**

This is a work in progress based on a working unit. I have rough drafts of the audio, video and modem sections, which I'll work on and post as I have time. Unfortunately it's unlikely I'll be able to draw the very important digital section as the digital traces all run under the main IC an I don't want to destroy this unit by removing this IC. The only way I'll be able to draw this section is with a DEAD 3100 and data sheet for LSI Logic's SC2000.

EchoStar 3100 / DP301 (with STi5512 processor)**:**

I've never seen this, but have read about it on the net. I'm currently looking for a dead but complete unit. I'll start drawing this as soon as I get my hands on one.

EchoStar with Separate PCB Power Supplies:

I was only a few minutes into the 9000 power supply, after having had done the 3000 power supply, when I realized that the 3000 and 9000 had the same power supply, the only difference being the labels. As it was a simple matter to copy and relabel, that's when I did. Anyway since the two supplies are the same, I'm guessing that most, if not all the EchoStar receivers which use a separate power supply are pretty much the same. So you don't find a schematic for the power supply of the exact model here, try one of these. I'm betting its pretty close!

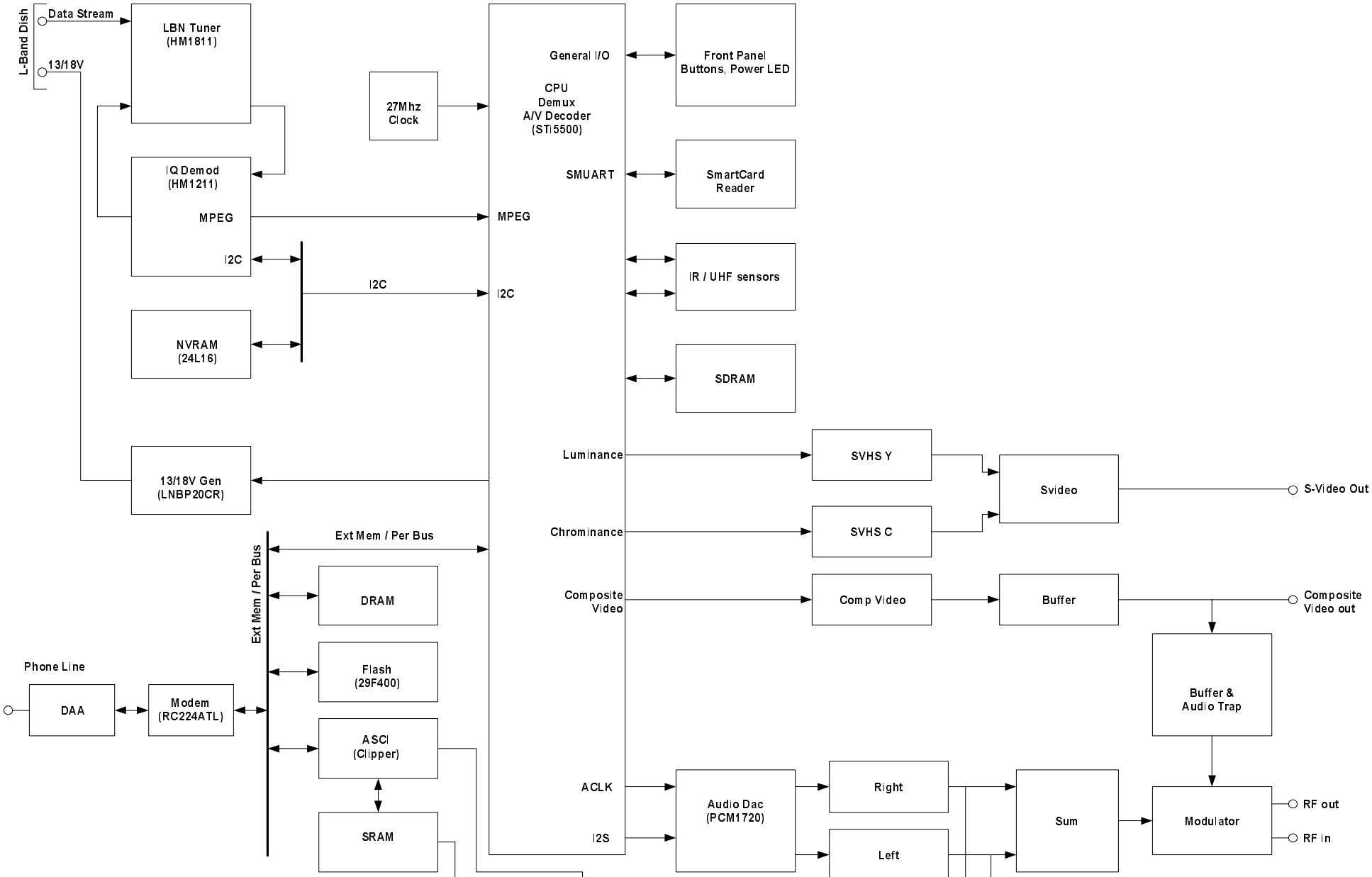
RCA DRD 420:

I emailed early beta copies of these schematics to a few friends on the net and within a couple hours two emailed me back with other schematics for this unit. While parts of these schematics are similar, other parts are quite different. This leads me to believe that there is at least two and maybe more versions of this model. So don't assume your 420 will match my schematics.

I'm also unable to e-mail or post copies of these other schematics as they were given to me in confidence and under the condition that I not spread them around.

On the main PCB only through hole components and ICs are labeled. This, in my opinion, is a very poor PCB design practice as it makes service very difficult.

Another problem with my schematics for this model is I'm unable to draw up schematics of either the LNB tuner or the modulator, due to the lack to datasheets for the the ICs used in these sections.



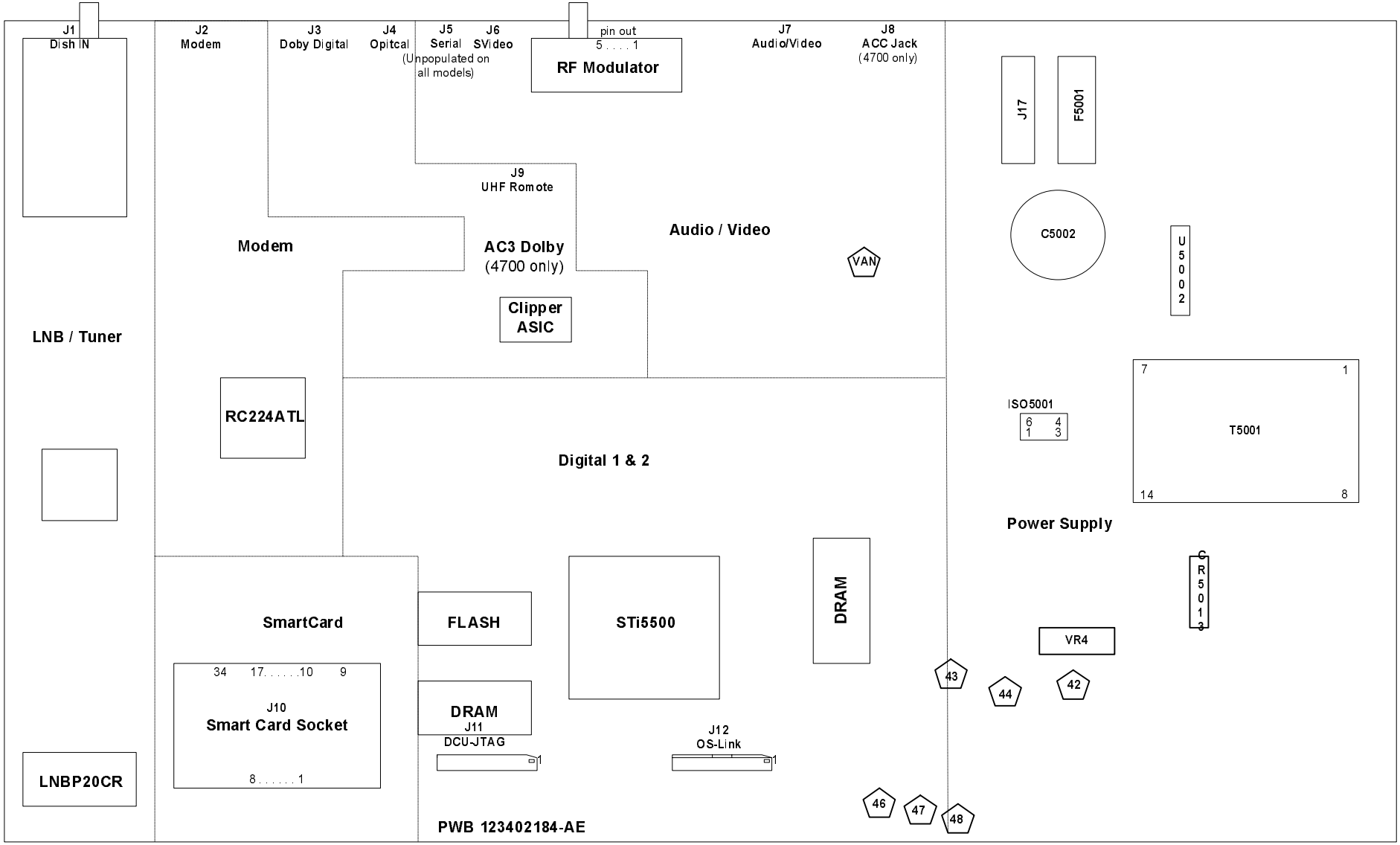
Title: **EchoStar 27/37/4700 Block Diagram**

Drawn by: MDevries, Canada.

Date: 19 / Dec / 2001

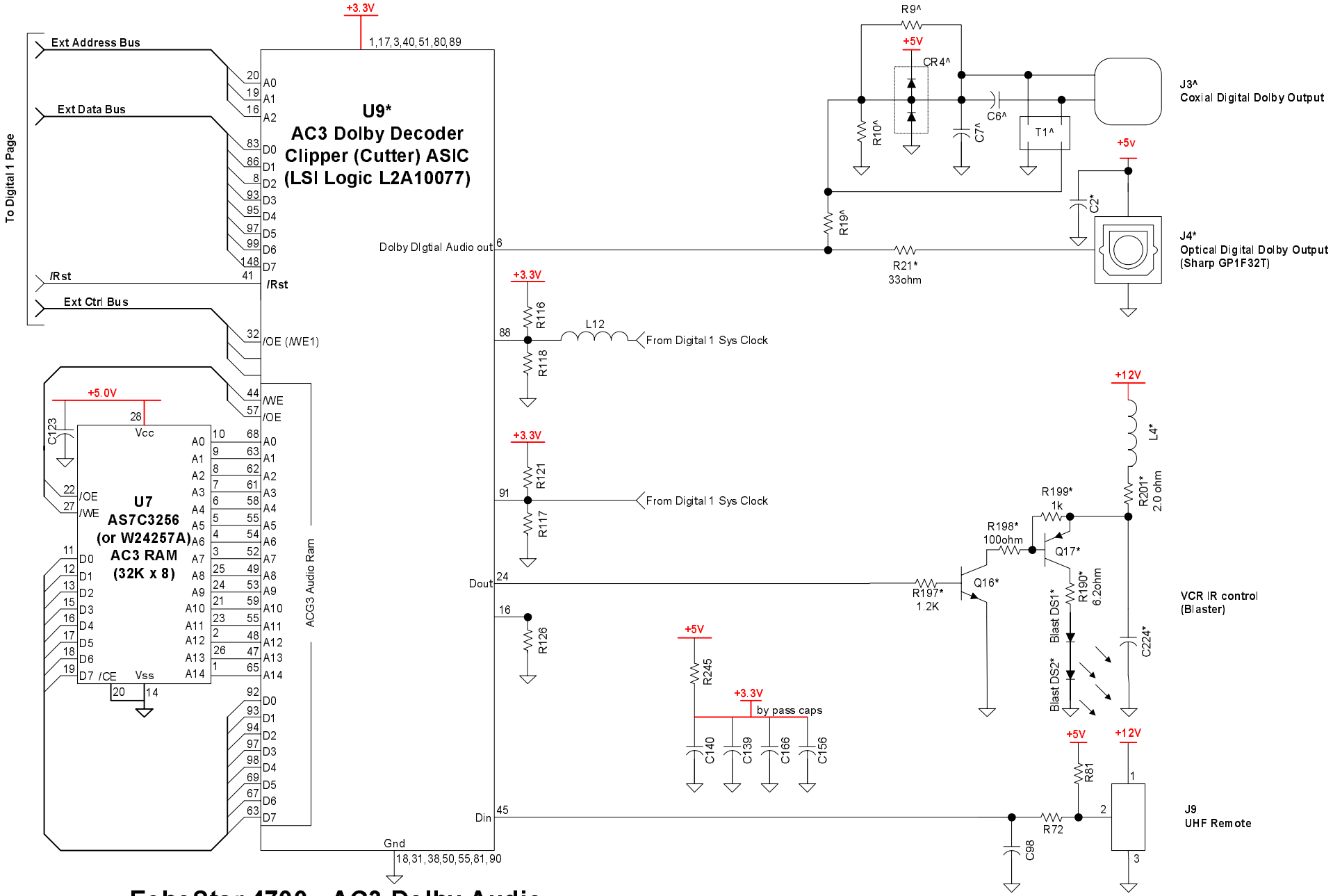
PCB: PWB 123402184-AE

Comment: While this block diagram is for the 27/37/4700, it is general enough to fit most EchoStar receivers of a similar generation.



Title: **EchoStar 27/37/4700 rev C Parts Layout**

Drawn by: MDevries, Canada.
Date: 1 / Dec / 2001
PCB: PWB 123402184-AE
Comment: This is the parts layout of the EchoStar satellite receiver models 2700 / 3700 / 4700 used by Bell Express UV in Canada and by DishNet in the USA.



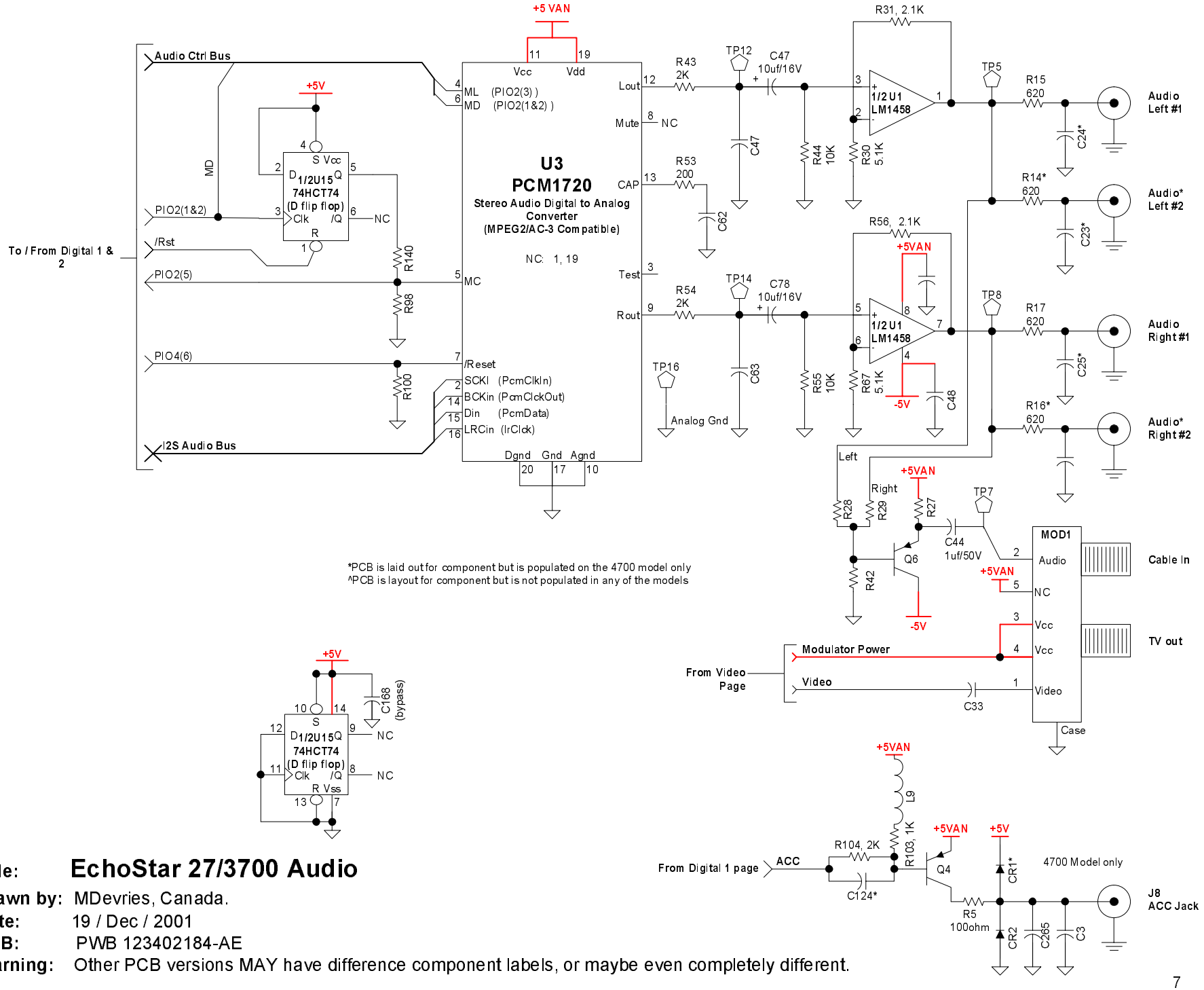
Title: **EchoStar 4700 - AC3 Dolby Audio**

Drawn by: MDevries, Canada.

Date: 10 / Feb / 2002

PCB: PWB 123402223-AE

Comment: Note this schematic was draw based on the missing parts in a 2700 and is NOT complete and also MAY not be correct.



*PCB is laid out for component but is populated on the 4700 model only
^PCB is layout for component but is not populated in any of the models

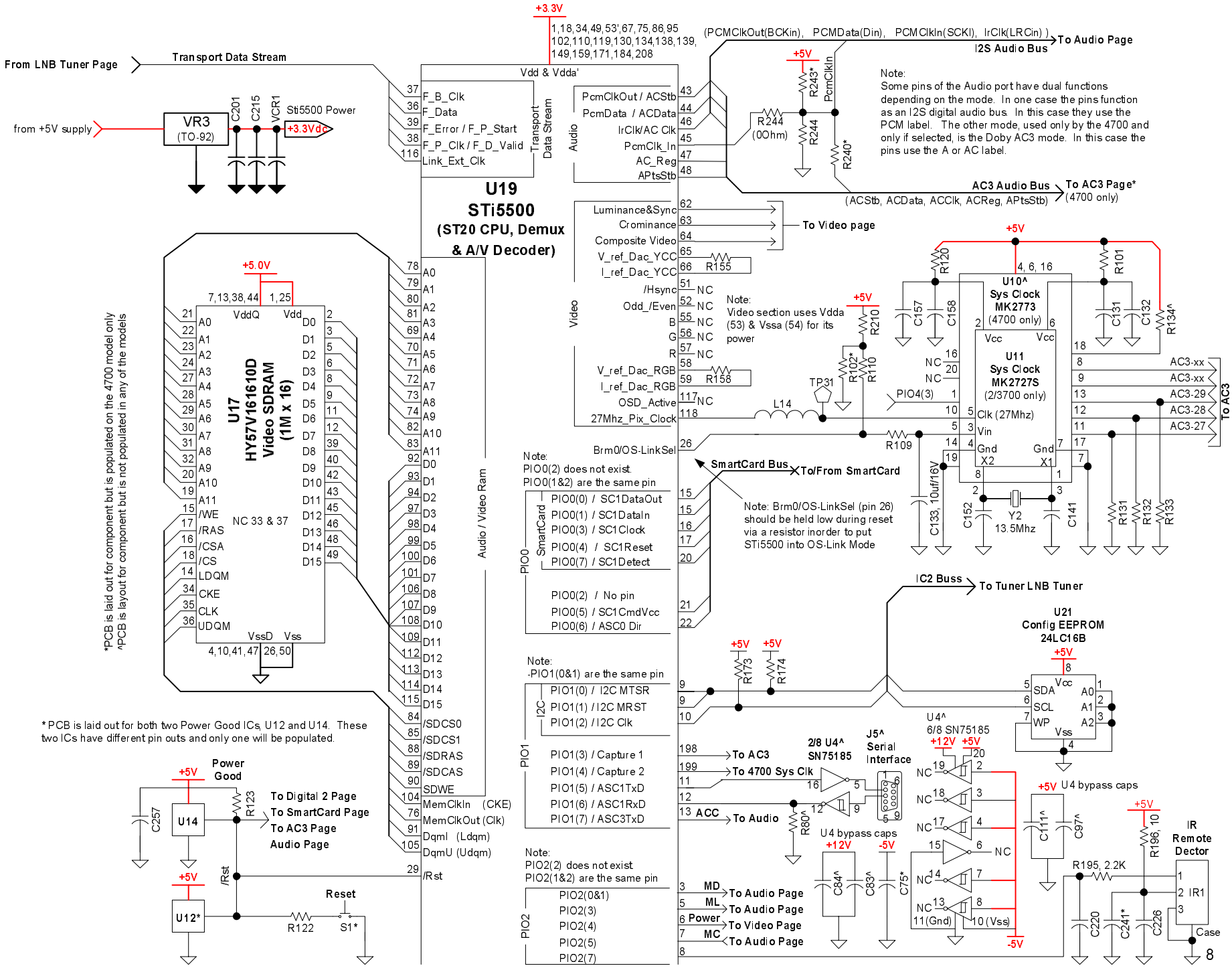
Title: **EchoStar 27/3700 Audio**

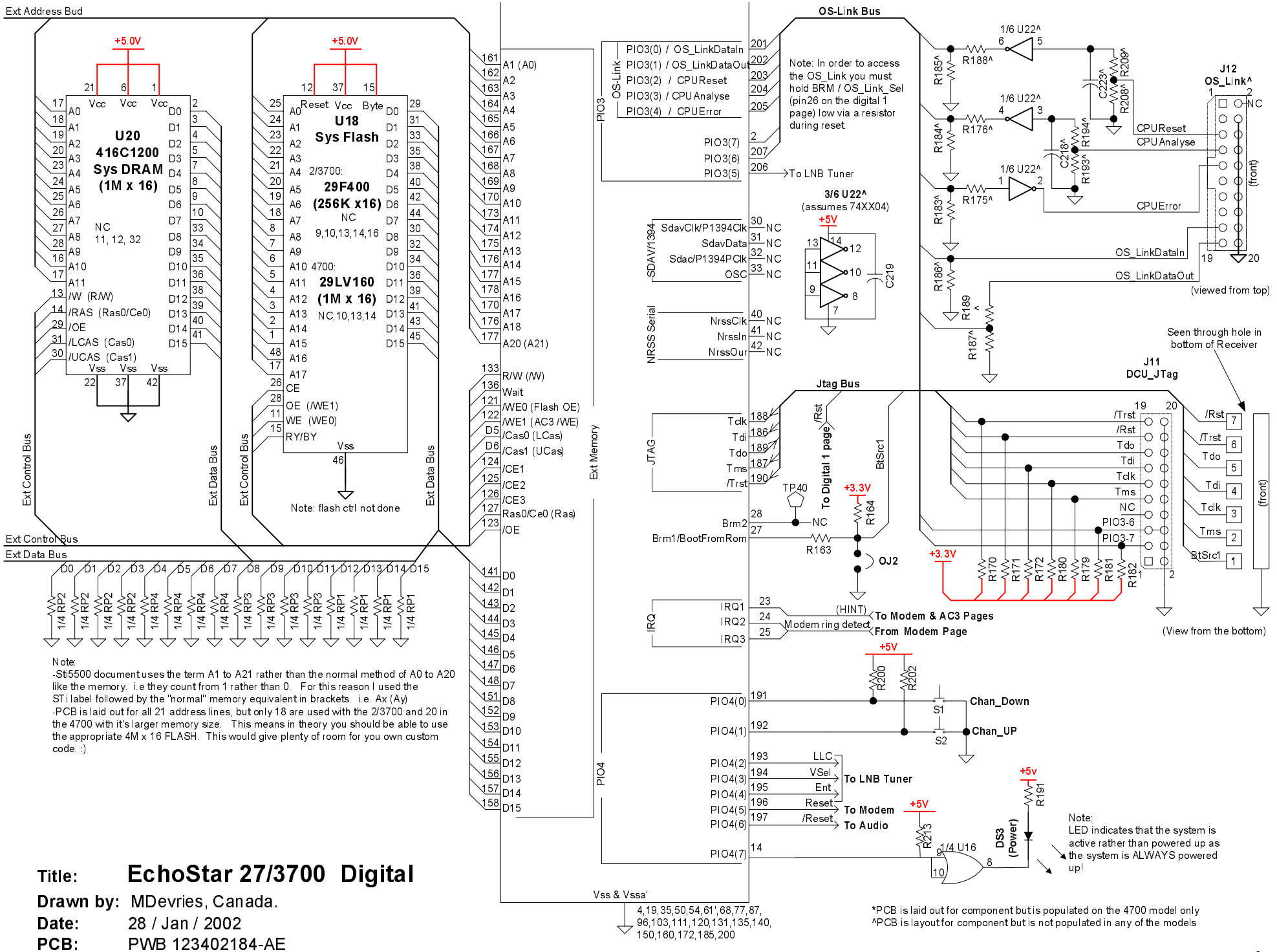
Drawn by: MDevries, Canada.

Date: 19 / Dec / 2001

PCB: PWB 123402184-AE

Warning: Other PCB versions MAY have difference component labels, or maybe even completely different.


From LNB Tuner Page
Transport Data Stream
from +5V supply
VR3
(TO-92)
C201
C215
VCR1
Sti5500 Power
+3.3Vdc
+3.3V
1,18,34,49,53',67,75,86,95
102,110,119,130,134,138,139,
149,159,171,184,208
Vdd & Vdda'
F_B_Clk
F_Data
F_Error / F_P_Start
F_P_Clk / F_D_Valid
Link_Ext_Clk
Transport Data Stream
U19
STi5500
(ST20 CPU, Demux
& A/V Decoder)
Audio
PcmClkOut / ACStb
PcmData / ACData
IrClk/AC Clk
PcmClk_In
AC_Reg
APtsStb
(PCMClkOut(BCKin), PCMData(Din), PCMClkIn(SCKI), IrClk(LRCin))
To Audio Page
I2S Audio Bus
+5V
R243*
PcmClkIn
R244
(0Ohm)
R244
R240*
Note:
Some pins of the Audio port have dual functions depending on the mode. In one case the pins function as an I2S digital audio bus. In this case they use the PCM label. The other mode, used only by the 4700 and only if selected, is the Doby AC3 mode. In this case the pins use the A or AC label.
AC3 Audio Bus
To AC3 Page*
(4700 only)
(ACStb, ACData, ACClk, ACReg, APtsStb)
Video
Luminance&Sync
Crominance
Composite Video
V_ref_Dac_YCC
I_ref_Dac_YCC
/Hsync
Odd_/Even
B
G
R
V_ref_Dac_RGB
I_ref_Dac_RGB
OSD_Active
27Mhz_Pix_Clock
NC
To Video page
R155
R158
Note:
Video section uses Vdda (53) & Vssa (54) for its power
+5V
R210
R102*
R110
TP31
L14
PIO4(3)
Brm0/OS-LinkSel
R109
SmartCard Bus
To/From SmartCard
Note: Brm0/OS-LinkSel (pin 26) should be held low during reset via a resistor inorder to put STi5500 into OS-Link Mode
U10^
Sys Clock
MK2773
(4700 only)
U11
Sys Clock
MK2727S
(2/3700 only)
Clk (27Mhz)
Vin
Gnd
Gnd
X2
X1
Y2
13.5Mhz
C133, 10uf/16V
C152
C141
R120
R101
C157
C158
C131
C132
R134^
R131
R132
R133
AC3-xx
AC3-xx
AC3-29
AC3-28
AC3-27
To AC3
+5.0V
7,13,38,44
1,25
VddQ
Vdd
U17
HY57V161610D
Video SDRAM
(1M x 16)
NC 33 & 37
VssD
Vss
4,10,41,47
26,50
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
/WE
/RAS
/CSA
/CS
LDQM
CKE
CLK
UDQM
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
Audio / Video Ram
/SDCS0
/SDCS1
/SDRAS
/SDCAS
SDWE
MemClkIn (CKE)
MemClkOut (Clk)
DqmI (Ldqm)
DqmU (Udqm)
/Rst
*PCB is laid out for component but is populated on the 4700 model only
^PCB is layout for component but is not populated in any of the models
* PCB is laid out for both two Power Good ICs, U12 and U14. These two ICs have different pin outs and only one will be populated.
Power
Good
U14
U12*
R123
C257
/Rst
Reset
R122
S1*
To Digital 2 Page
To SmartCard Page
To AC3 Page
Audio Page
PIO0
SmartCard
PIO0(0) / SC1DataOut
PIO0(1) / SC1DataIn
PIO0(3) / SC1Clock
PIO0(4) / SC1Reset
PIO0(7) / SC1Detect
PIO0(2) / No pin
PIO0(5) / SC1CmdVcc
PIO0(6) / ASC0 Dir
Note:
PIO0(2) does not exist.
PIO0(1&2) are the same pin
PIO1
I2C
PIO1(0) / I2C MTSR
PIO1(1) / I2C MRST
PIO1(2) / I2C Clk
PIO1(3) / Capture 1
PIO1(4) / Capture 2
PIO1(5) / ASC1TxD
PIO1(6) / ASC1RxD
PIO1(7) / ASC3TxD
Note:
-PIO1(0&1) are the same pin
PIO2
PIO2(0&1)
PIO2(3)
PIO2(4)
PIO2(5)
PIO2(7)
Note:
PIO2(2) does not exist
PIO2(1&2) are the same pin
MD
ML
Power
MC
To Audio Page
To Audio Page
To Video Page
To Audio Page
To AC3
To 4700 Sys Clk
ACC
To Audio
R80^
2/8 U4^
SN75185
J5^
Serial
Interface
U4^
6/8 SN75185
U4 bypass caps
+12V
-5V
C84^
C83^
C75*
C111^
C97^
I2C Buss
To Tuner LNB Tuner
U21
Config EEPROM
24LC16B
SDA
SCL
WP
Vcc
Vss
A0
A1
A2
R173
R174
R195, 2.2K
R196, 10
C220
C241*
C226
IR
Remote
Dector
IR1
Case
8



Note:
-Sti5500 document uses the term A1 to A21 rather than the normal method of A0 to A20 like the memory. i.e they count from 1 rather than 0. For this reason I used the STi label followed by the "normal" memory equivalent in brackets. i.e. Ax (Ay)
-PCB is laid out for all 21 address lines, but only 18 are used with the 2/3700 and 20 in the 4700 with it's larger memory size. This means in theory you should be able to use the appropriate 4M x 16 FLASH. This would give plenty of room for you own custom code. :)

*PCB is laid out for component but is populated on the 4700 model only
^PCB is layout for component but is not populated in any of the models

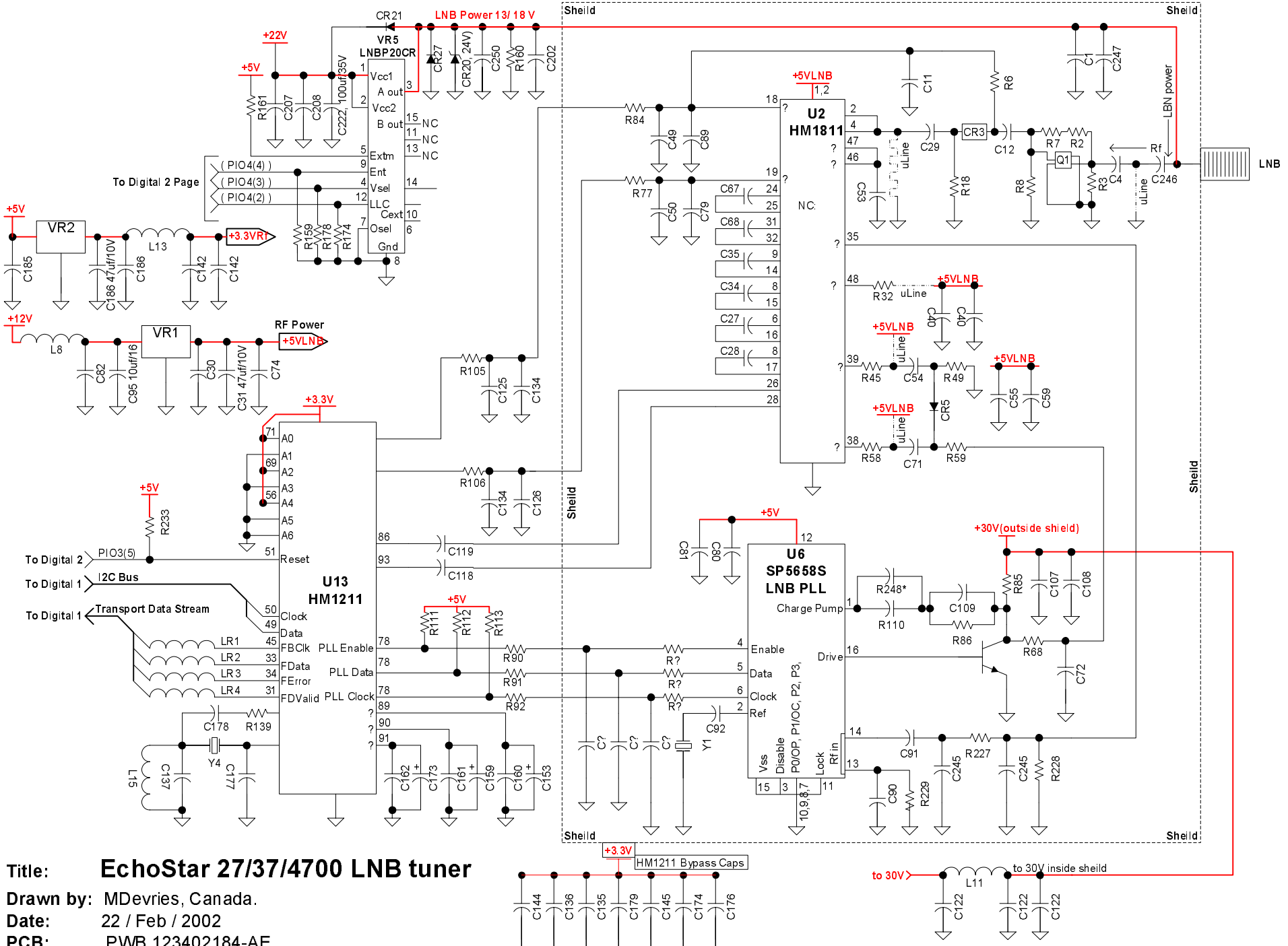
Title: **EchoStar 27/3700 Digital**

Drawn by: MDevries, Canada.

Date: 28 / Jan / 2002

PCB: PWB 123402184-AE

Warning: Other PCB versions may have different component labels or maybe even be completely different.



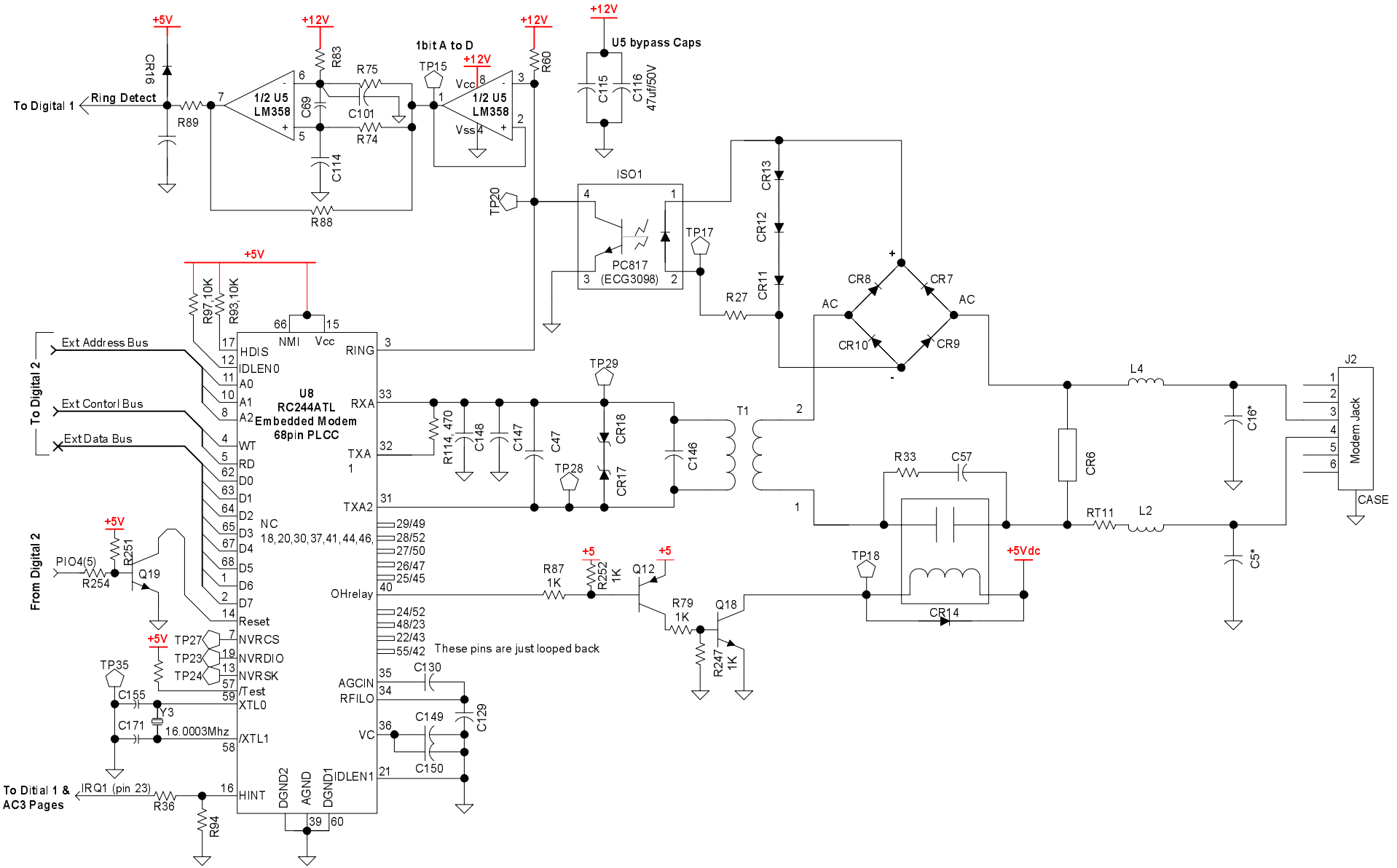
Title: **EchoStar 27/37/4700 LNB tuner**

Drawn by: MDevries, Canada.

Date: 22 / Feb / 2002

PCB: PWB 123402184-AE

Comment: Drawn with out the aid of data sheets so I had no way to cross check, as a result don't assume anything on this page is correct.



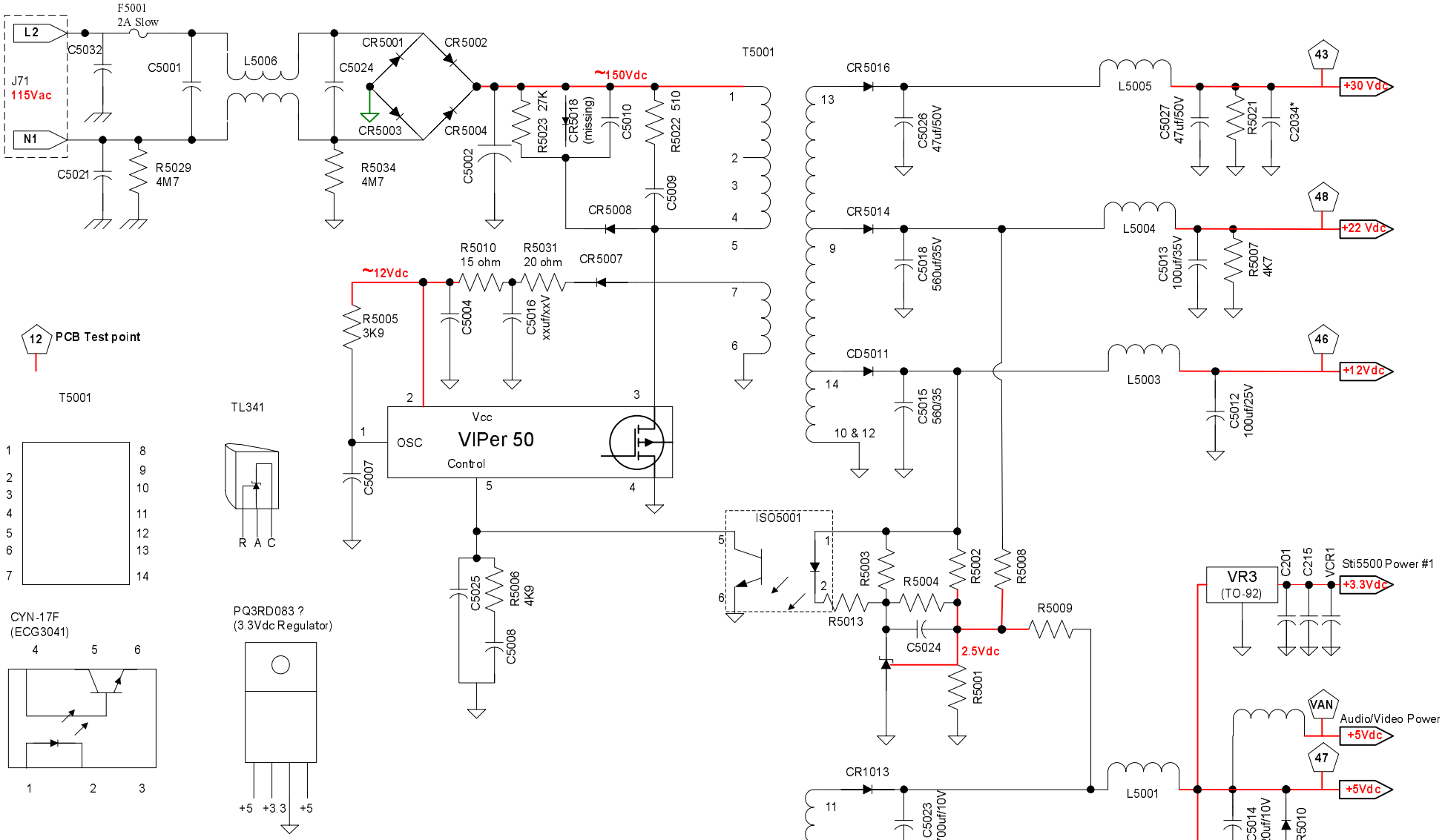
Title: **EchoStar 27/37/4700 Modem**

Drawn by: MDevries, Canada.

Date: 9/ Jan / 2002

PCB: 123402184-AE

Warning: Other PCBS (may) have different parts designators



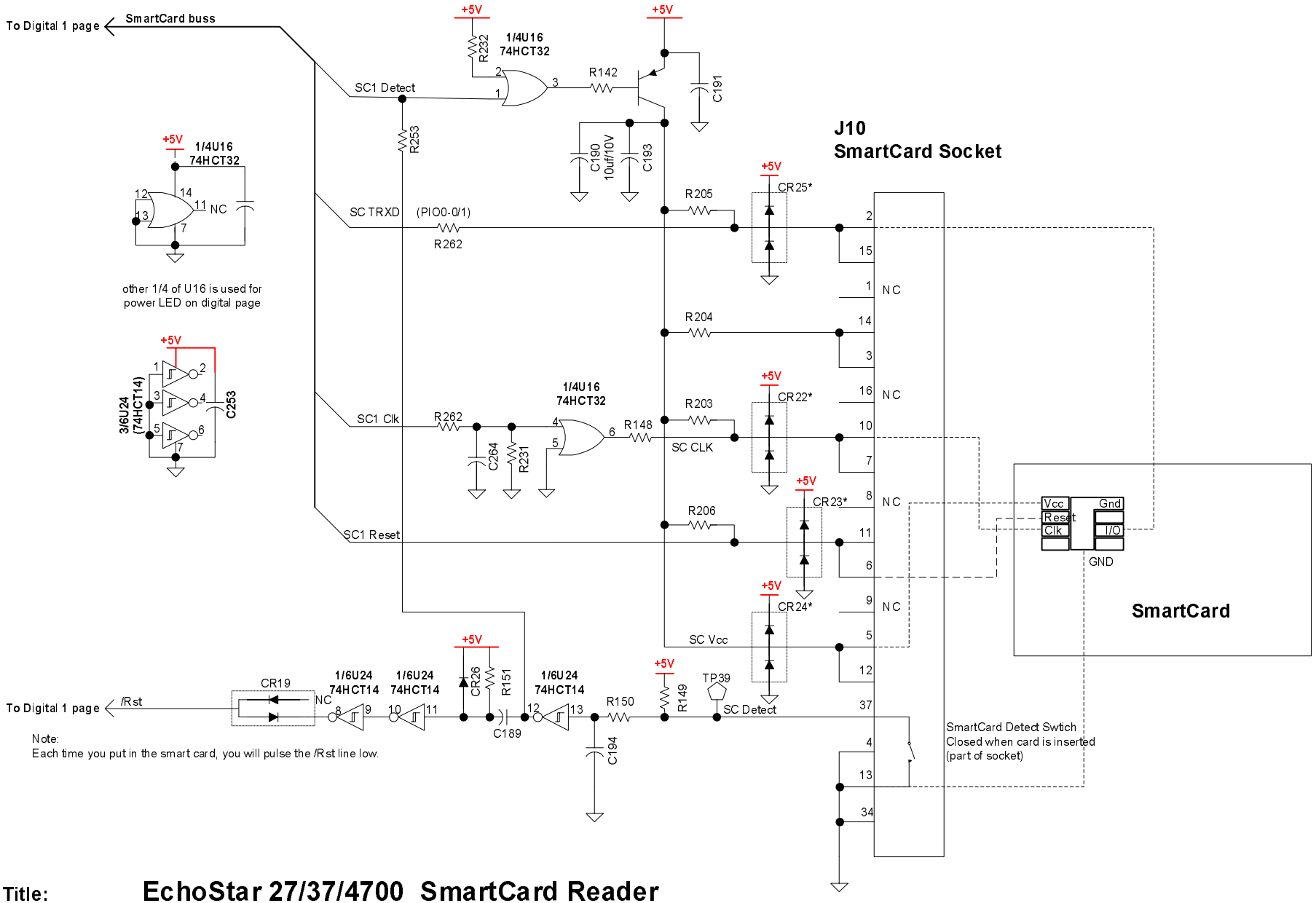
Title: **EchoStar 27/37/4700 rev C Power Supply**

Drawn by: MDevries, Canada.

Date: 1 / Dec / 2001

PCB: PWB 123402184-AE

Warning: Other PCB versions may have different component labels or maybe even be completely different.



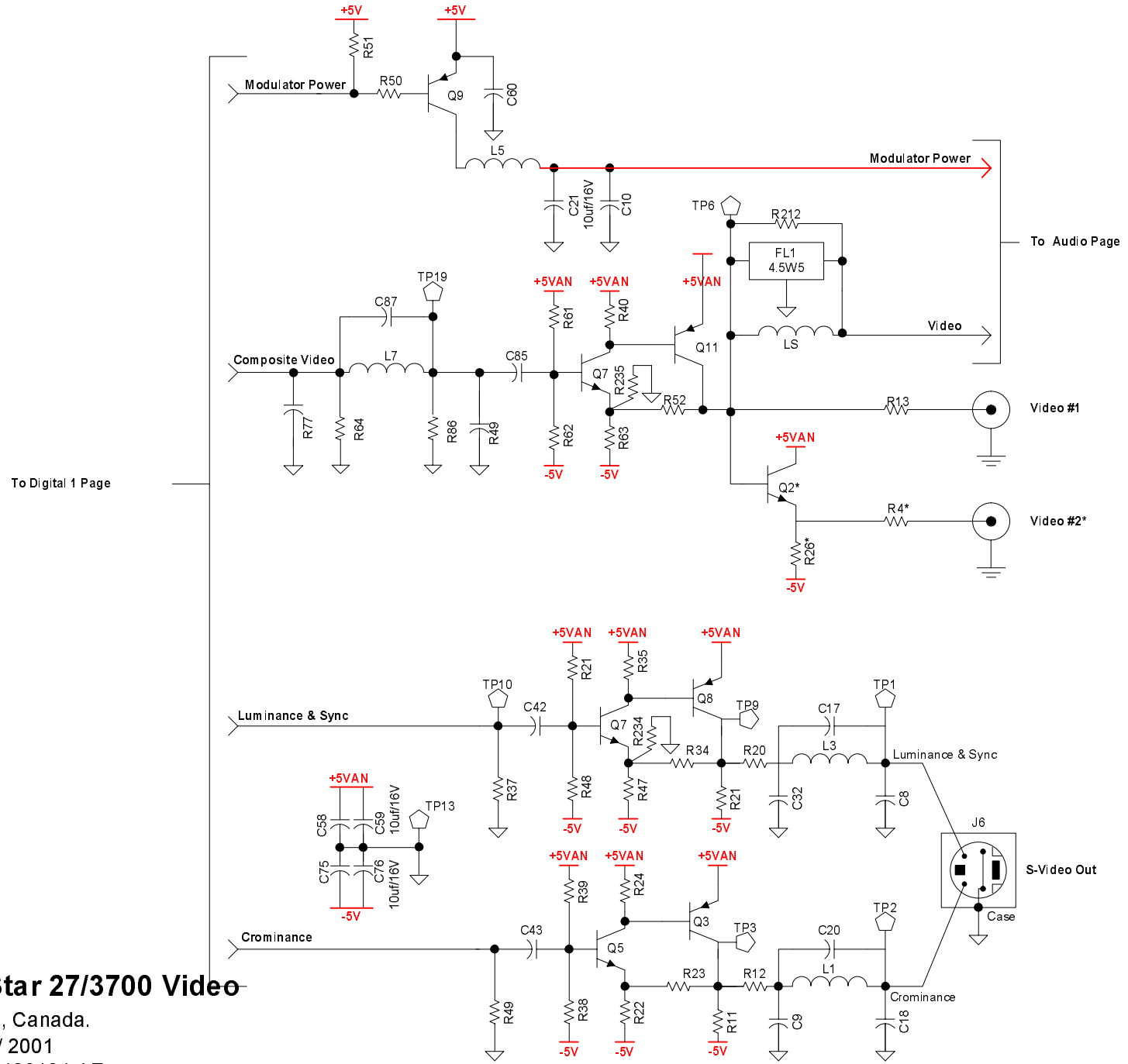
Title: **EchoStar 27/37/4700 SmartCard Reader**

Drawn by: MDevries, Canada.

Date: 20 / Jan / 2002

PCB: PWB 123402184-AE

Warning: Other PCB versions may have different component labels or maybe even be completely different.



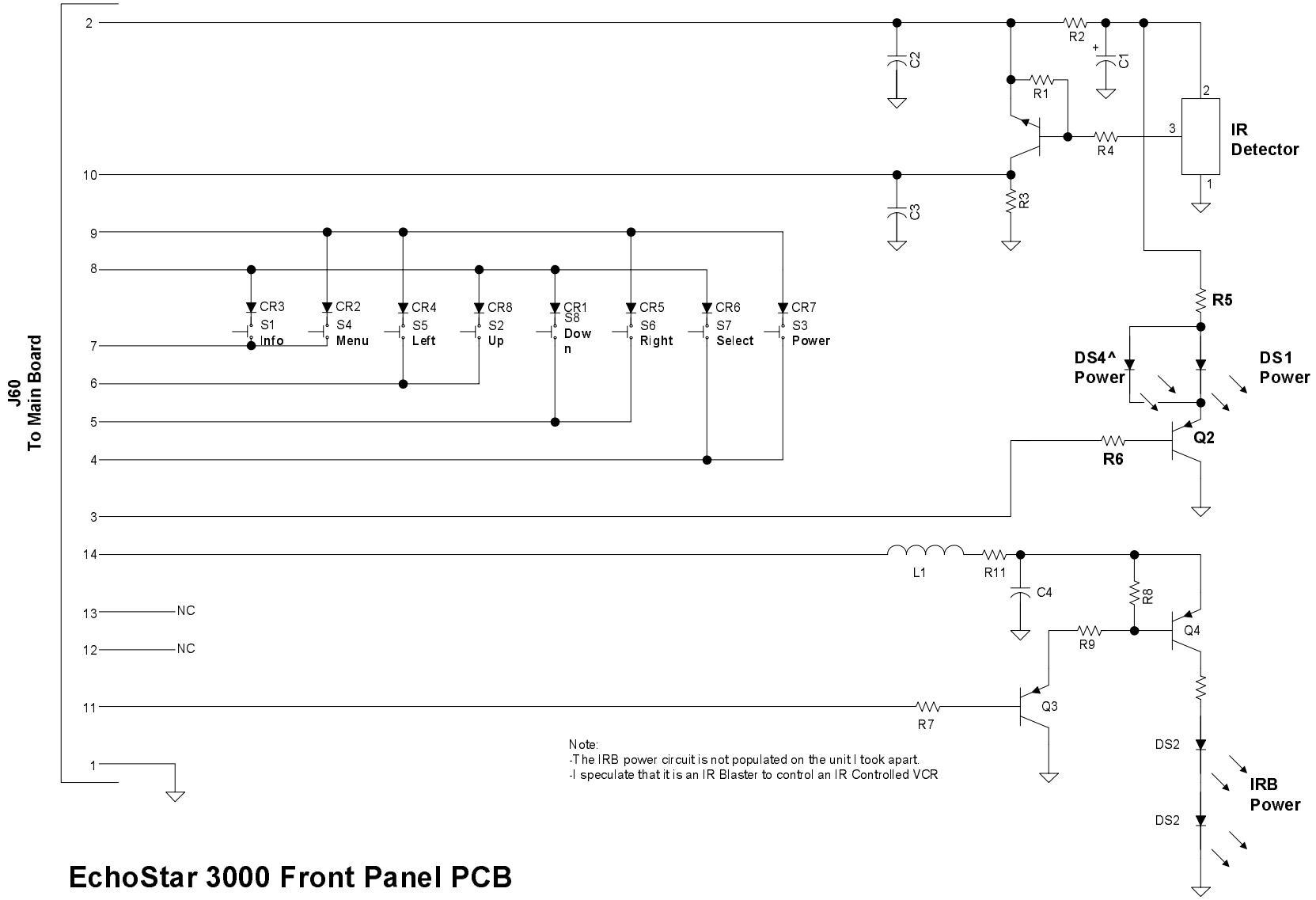
Title: **EchoStar 27/3700 Video**

Drawn by: MDevries, Canada.

Date: 19 / Dec / 2001

PCB: PWB 123402184-AE

Warning: Other PCB versions MAY have difference component labels, or maybe even completely different.



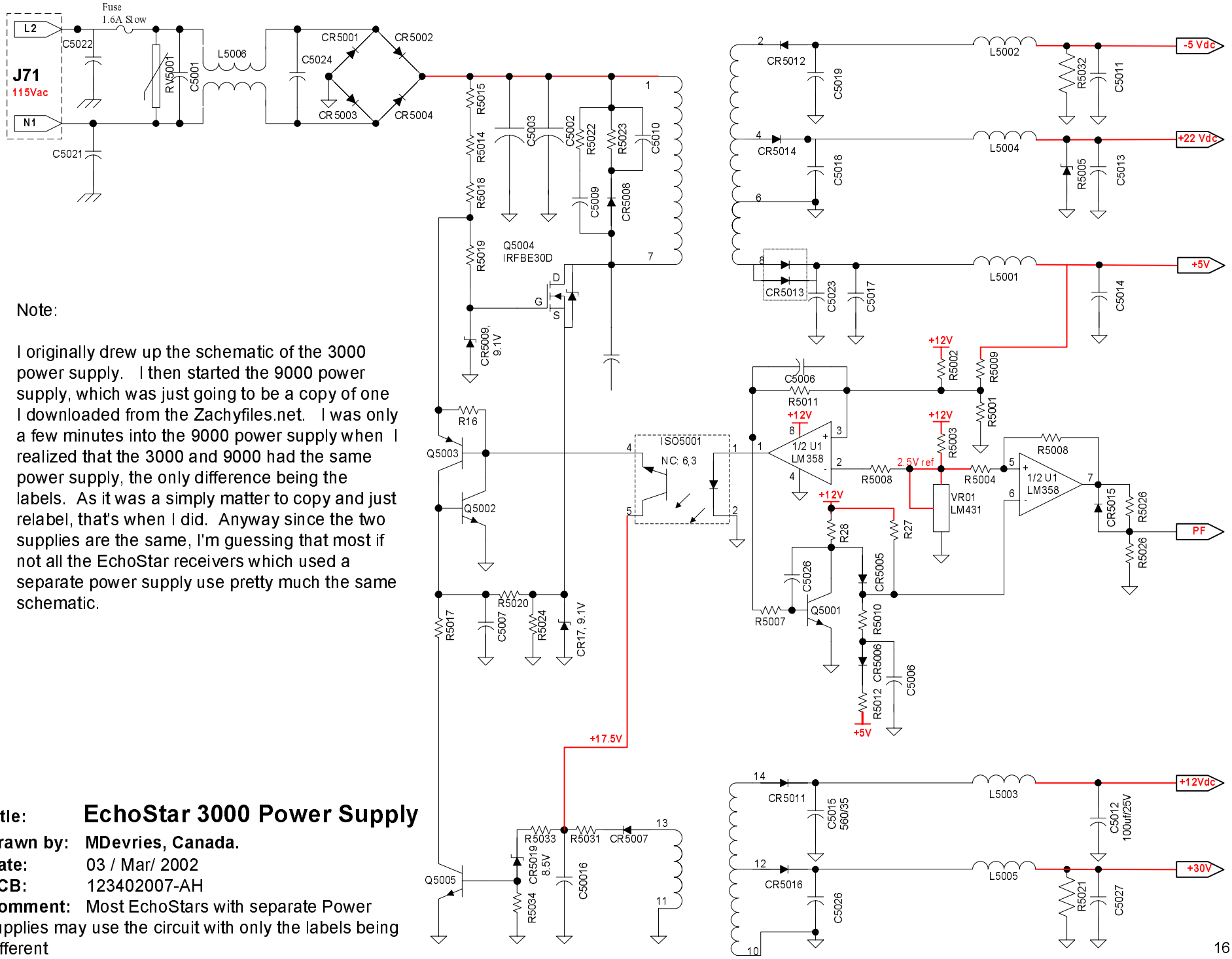
Title: **EchoStar 3000 Front Panel PCB**

Drawn by: MDevries, Canada.

Date: 25 / Feb / 2002

PCB: PWB 123402097-AA

Warning: Other PCB versions MAY have difference component labels, or maybe even completely different.



Note:

I originally drew up the schematic of the 3000 power supply. I then started the 9000 power supply, which was just going to be a copy of one I downloaded from the Zachyfiles.net. I was only a few minutes into the 9000 power supply when I realized that the 3000 and 9000 had the same power supply, the only difference being the labels. As it was a simply matter to copy and just relabel, that's when I did. Anyway since the two supplies are the same, I'm guessing that most if not all the EchoStar receivers which used a separate power supply use pretty much the same schematic.

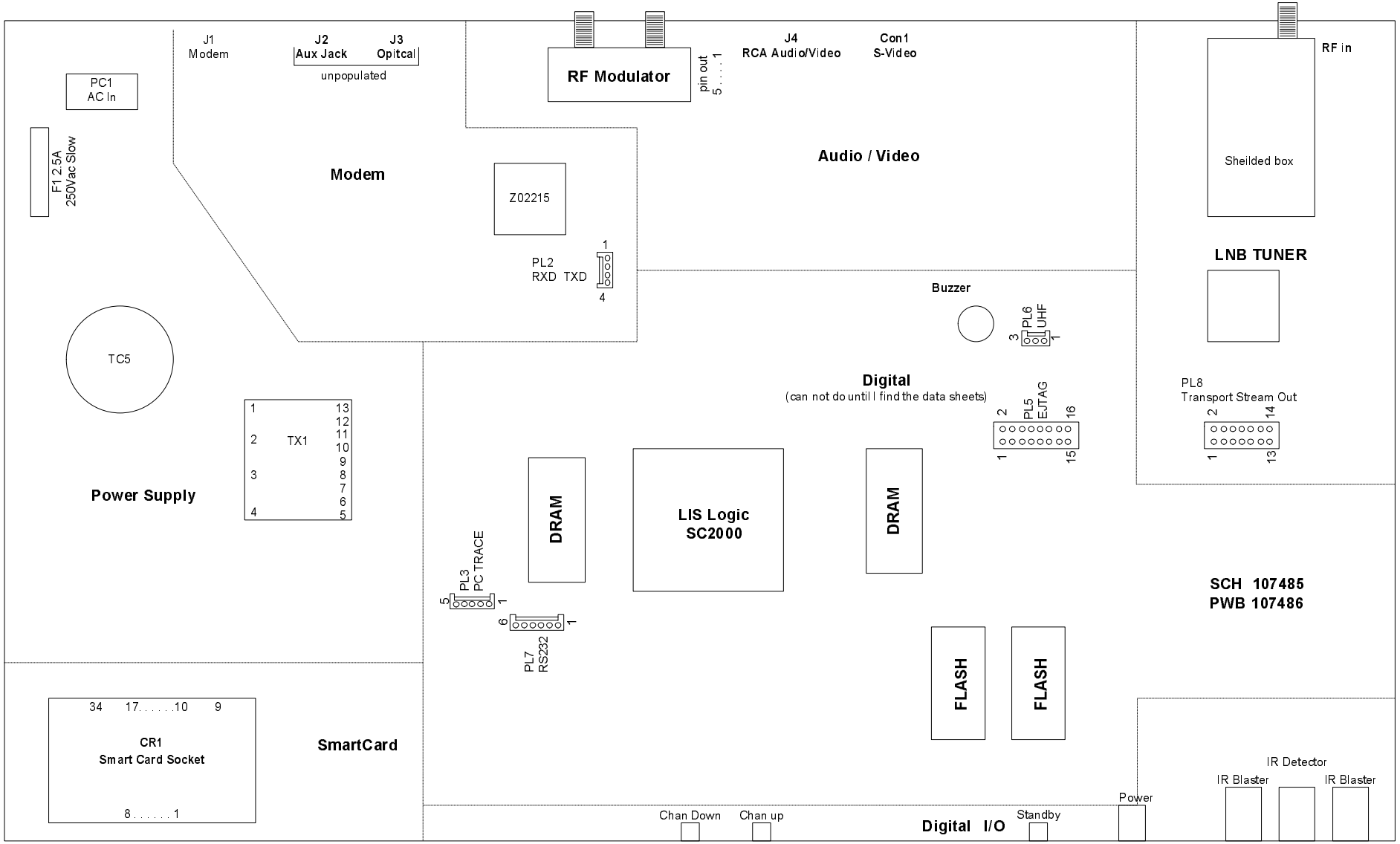
Title: **EchoStar 3000 Power Supply**

Drawn by: **MDevries, Canada.**

Date: 03 / Mar/ 2002

PCB: 123402007-AH

Comment: Most EchoStars with separate Power supplies may use the circuit with only the labels being different



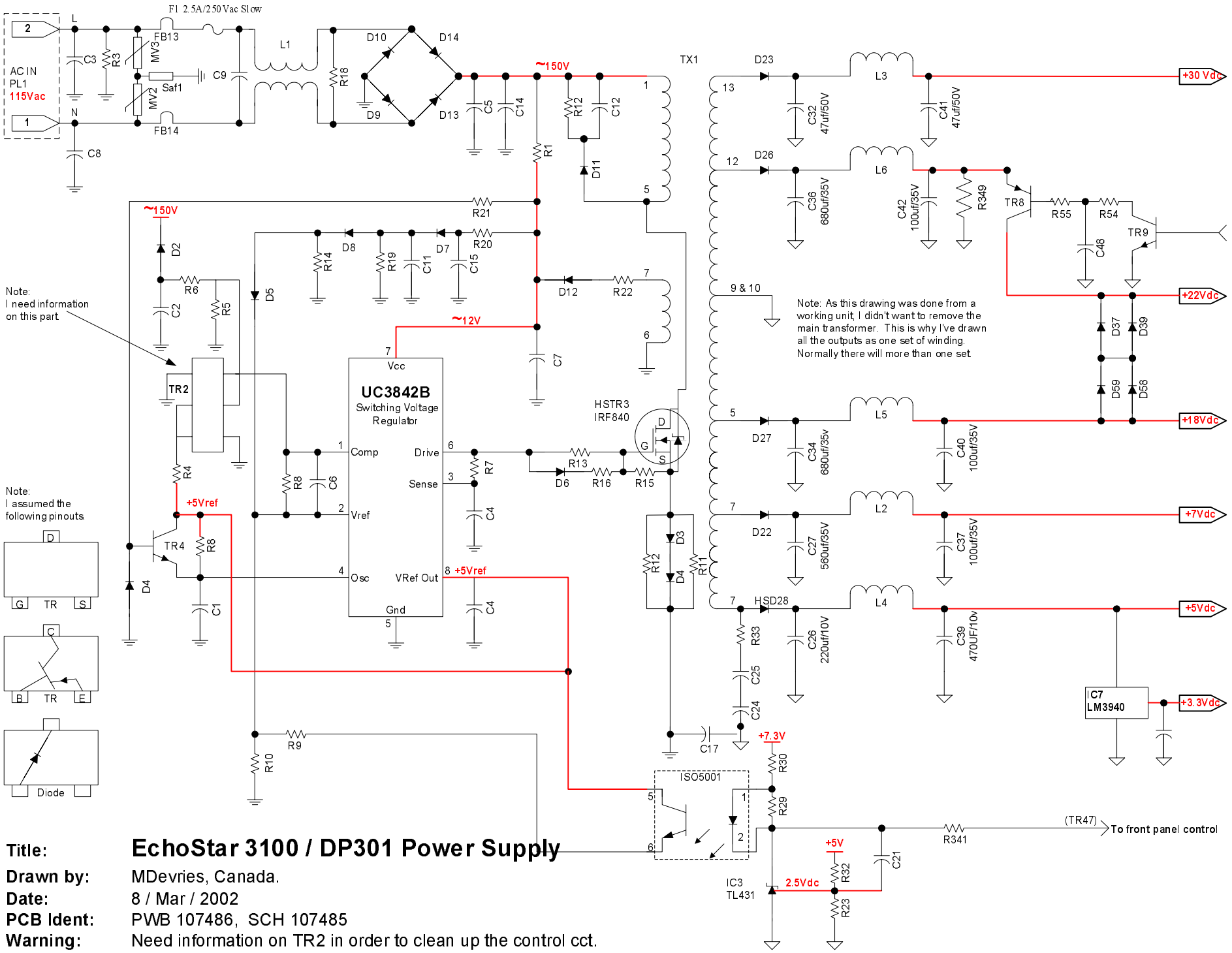
Title: **EchoStar 3100 / DP301 Parts Layout** (with SC2000 processor)

Drawn by: MDevries, Canada.

Date: 5 / Mar / 2002

PCB Ident: PWB 107486, SCH 107485

Comment: This is the parts layout of the EchoStar satellite receiver, model 3100 used by Bell Express UV in Canada and model DP301 used by DishNet in the USA.



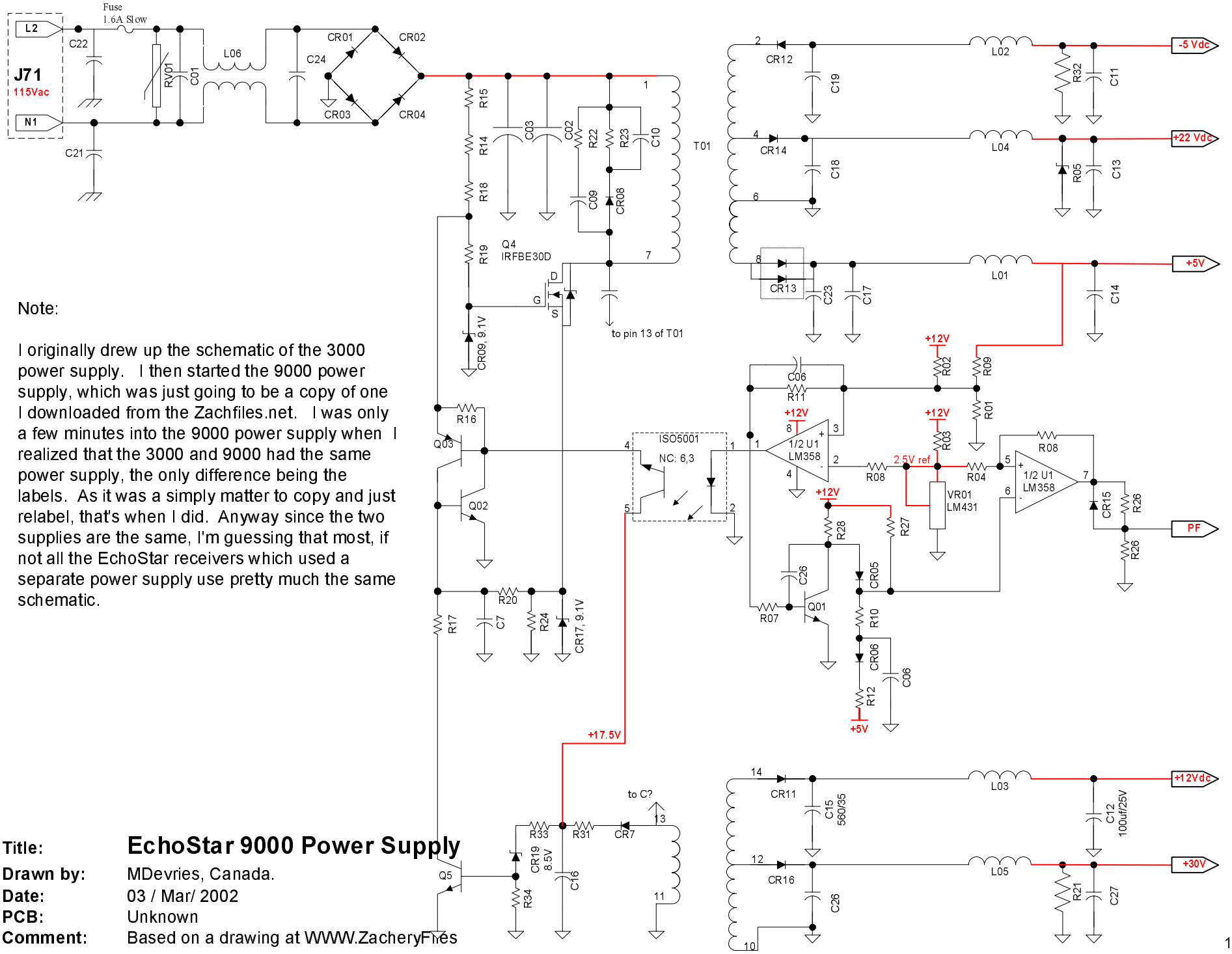
Title: **EchoStar 3100 / DP301 Power Supply**

Drawn by: MDevries, Canada.

Date: 8 / Mar / 2002

PCB Ident: PWB 107486, SCH 107485

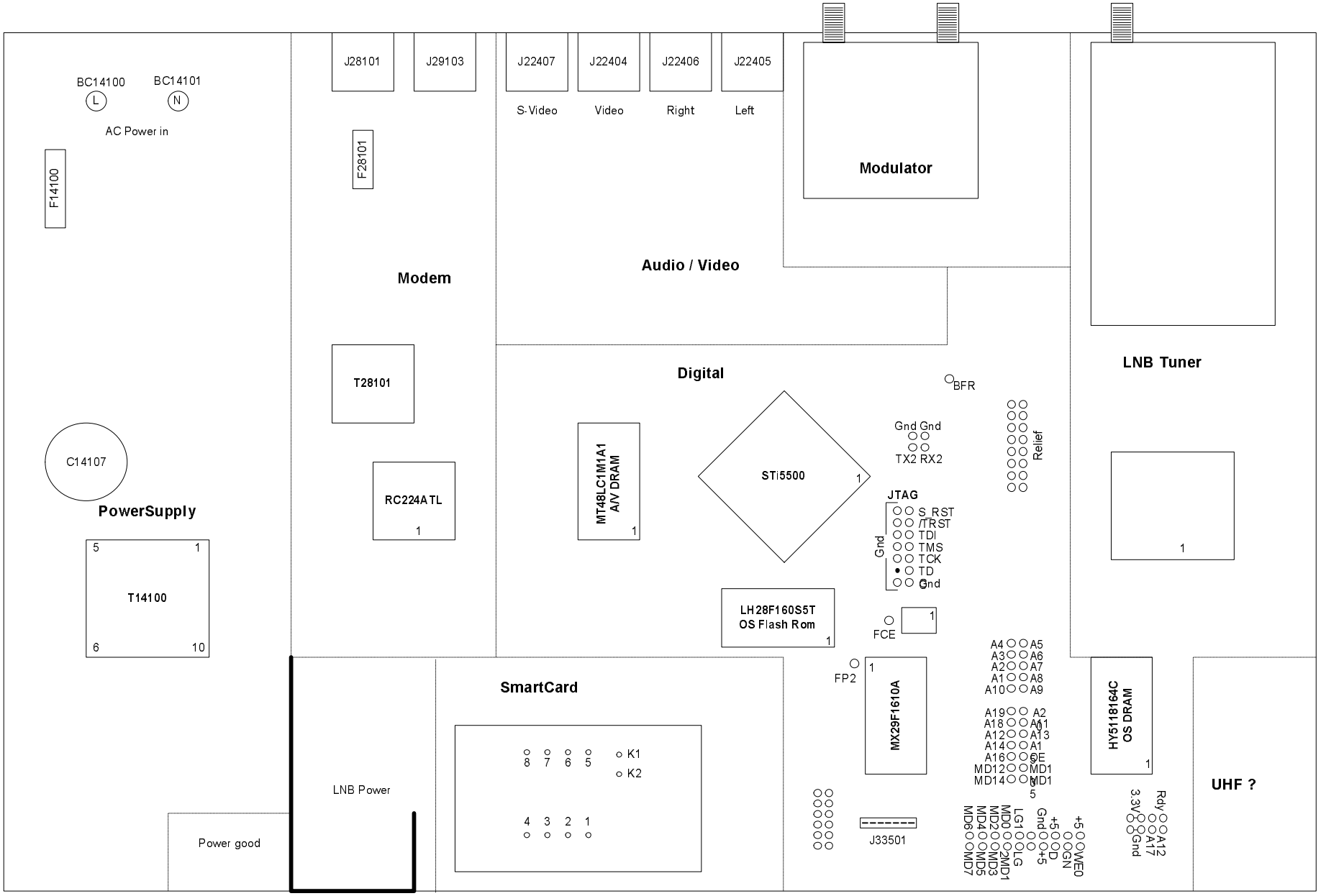
Warning: Need information on TR2 in order to clean up the control cct.



Note:

I originally drew up the schematic of the 3000 power supply. I then started the 9000 power supply, which was just going to be a copy of one I downloaded from the Zachfiles.net. I was only a few minutes into the 9000 power supply when I realized that the 3000 and 9000 had the same power supply, the only difference being the labels. As it was a simply matter to copy and just relabel, that's when I did. Anyway since the two supplies are the same, I'm guessing that most, if not all the EchoStar receivers which used a separate power supply use pretty much the same schematic.

Title: **EchoStar 9000 Power Supply**
Drawn by: MDevries, Canada.
Date: 03 / Mar/ 2002
PCB: Unknown
Comment: Based on a drawing at WWW.ZacheryFiles

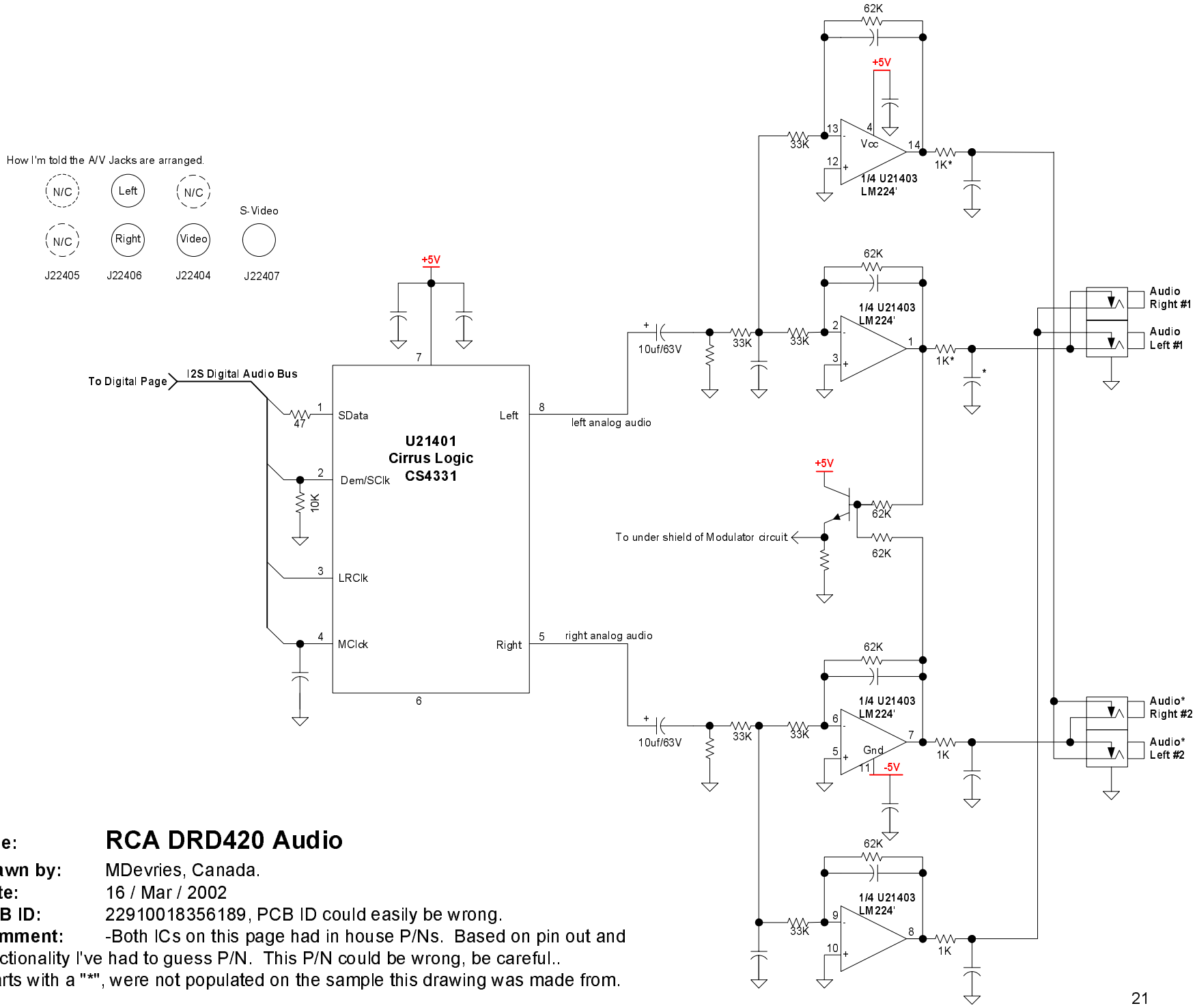


Title: **RCA DRD420 Parts Layout**

Drawn by: MDevries, Canada.

Date: 10 / Mar / 2002

PCB Ident: 22910018356189 (this could be wrong)



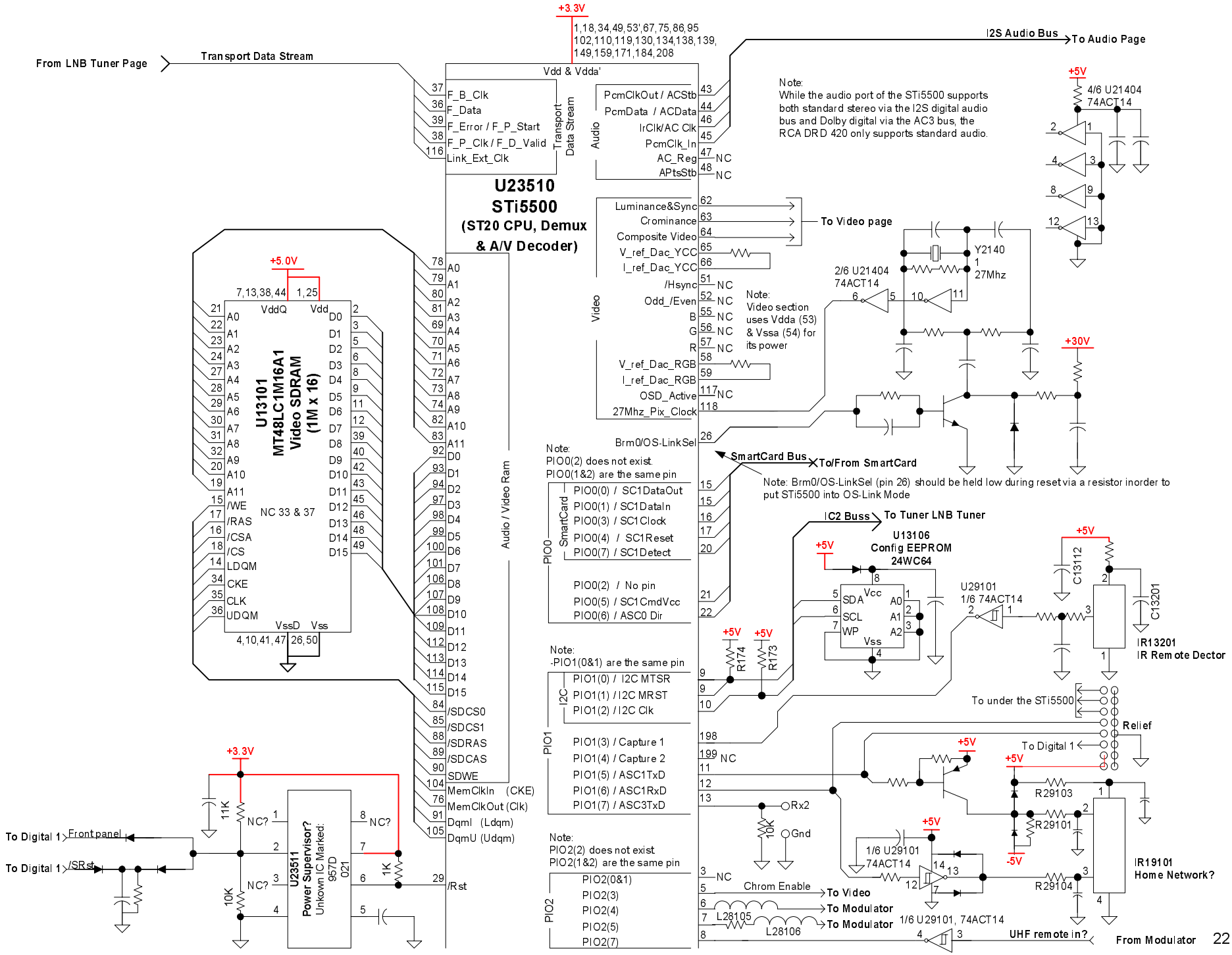
Title: **RCA DRD420 Audio**

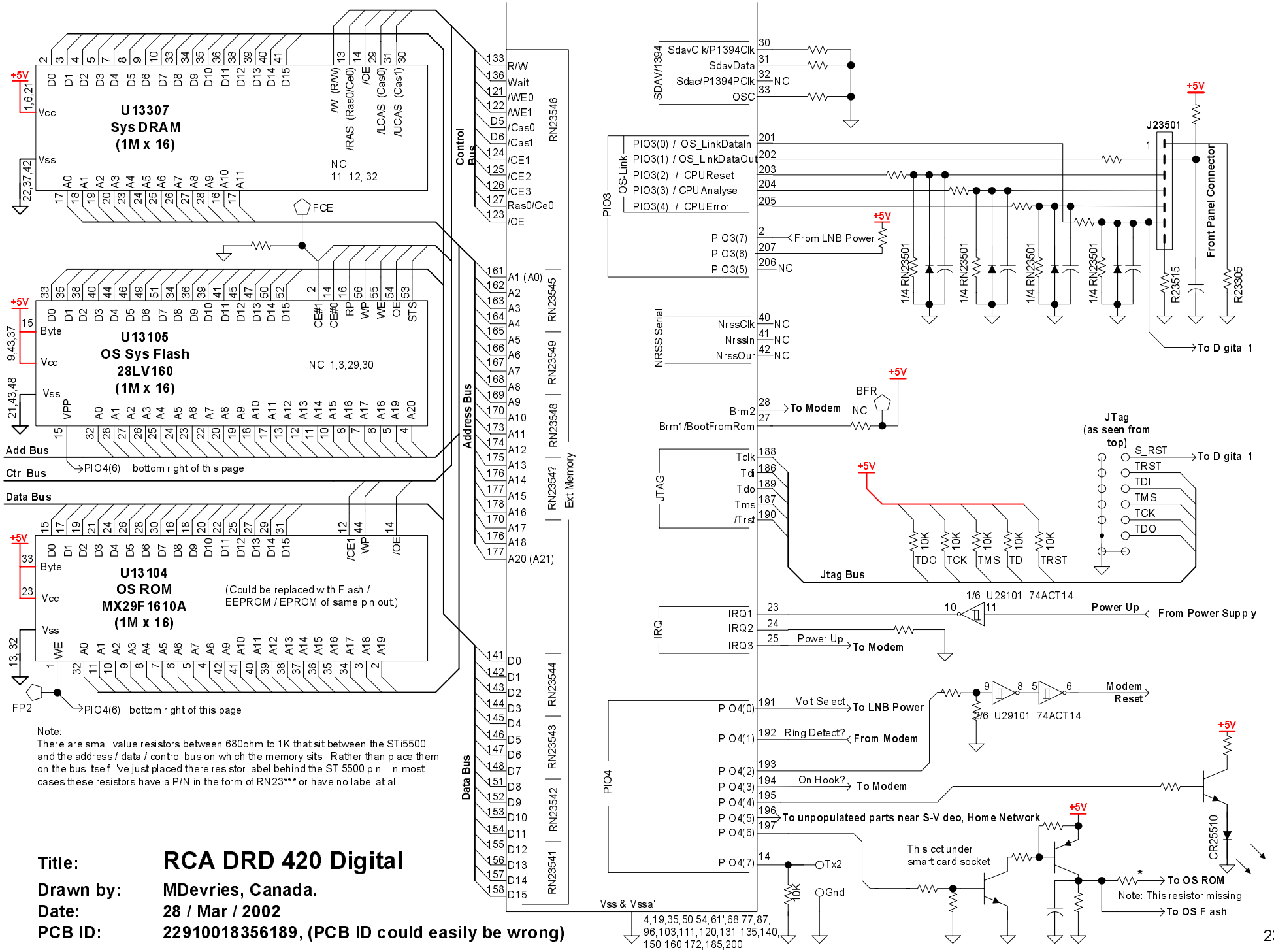
Drawn by: MDevries, Canada.

Date: 16 / Mar / 2002

PCB ID: 22910018356189, PCB ID could easily be wrong.

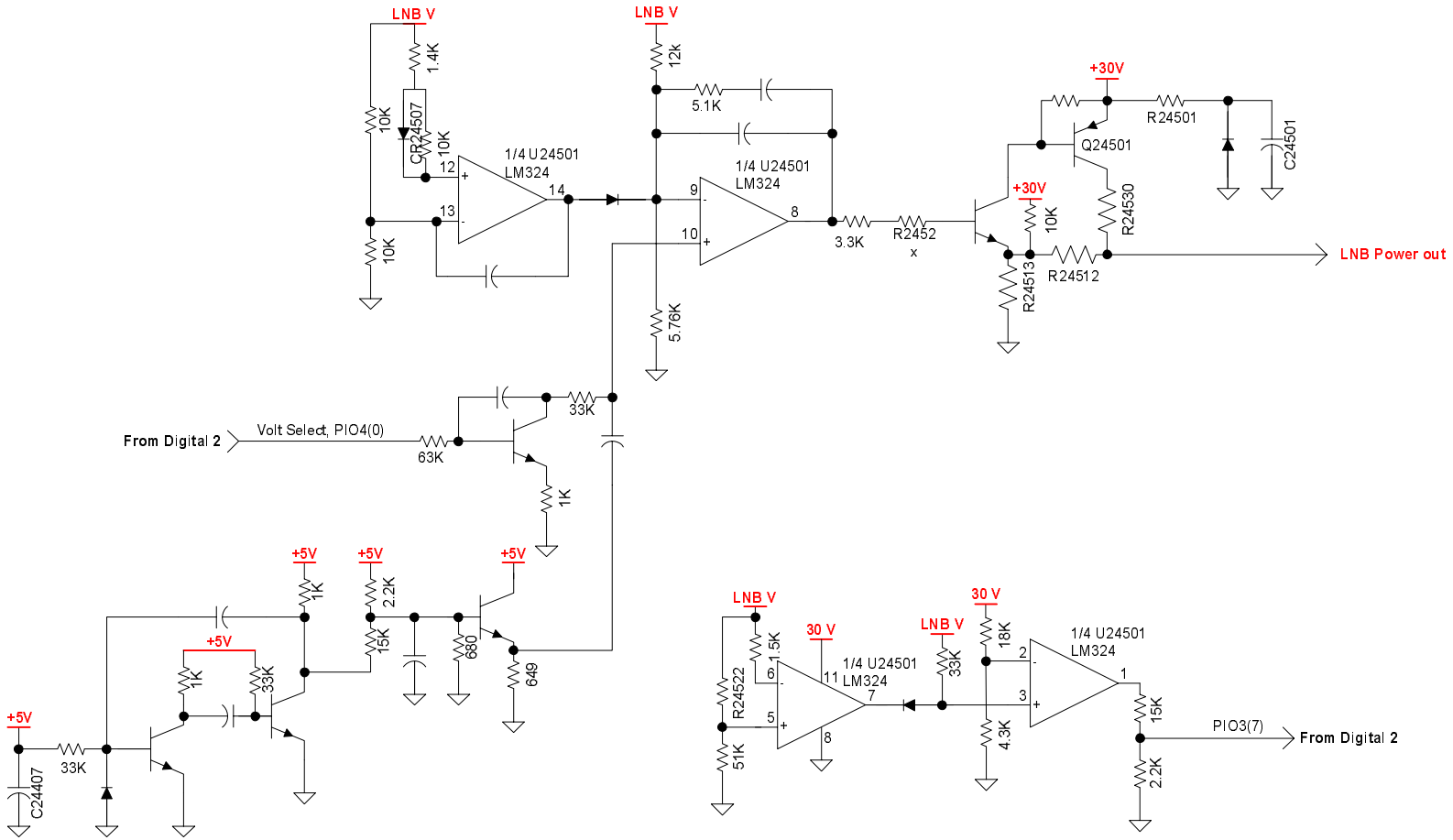
Comment: -Both ICs on this page had in house P/Ns. Based on pin out and functionality I've had to guess P/N. This P/N could be wrong, be careful..
-Parts with a "*", were not populated on the sample this drawing was made from.


From LNB Tuner Page
Transport Data Stream
+3.3V
1,18,34,49,53',67,75,86,95
102,110,119,130,134,138,139,
149,159,171,184,208
Vdd & Vdda'
U23510
STi5500
(ST20 CPU, Demux
& A/V Decoder)
F_B_Clk
F_Data
F_Error / F_P_Start
F_P_Clk / F_D_Valid
Link_Ext_Clk
Transport Data Stream
Audio
PcmClkOut / ACStb
PcmData / ACData
IrClk/AC Clk
PcmClk_In
AC_Reg
APtsStb
I2S Audio Bus
To Audio Page
Note:
While the audio port of the STi5500 supports both standard stereo via the I2S digital audio bus and Dolby digital via the AC3 bus, the RCA DRD 420 only supports standard audio.
+5V
4/6 U21404
74ACT14
Video
Luminance&Sync
Crominance
Composite Video
V_ref_Dac_YCC
I_ref_Dac_YCC
/Hsync
Odd_/Even
B
G
R
V_ref_Dac_RGB
I_ref_Dac_RGB
OSD_Active
27Mhz_Pix_Clock
To Video page
Note:
Video section uses Vdda (53) & Vssa (54) for its power
2/6 U21404
74ACT14
Y2140
1
27Mhz
+30V
Brm0/OS-LinkSel
SmartCard Bus
To/From SmartCard
Note: Brm0/OS-LinkSel (pin 26) should be held low during reset via a resistor inorder to put STi5500 into OS-Link Mode
Note:
PIO0(2) does not exist.
PIO0(1&2) are the same pin
PIO0
SmartCard
PIO0(0) / SC1DataOut
PIO0(1) / SC1DataIn
PIO0(3) / SC1Clock
PIO0(4) / SC1Reset
PIO0(7) / SC1Detect
PIO0(2) / No pin
PIO0(5) / SC1CmdVcc
PIO0(6) / ASC0 Dir
I2C Buss
To Tuner LNB Tuner
U13106
Config EEPROM
24WC64
SDA
SCL
WP
Vcc
Vss
A0
A1
A2
U29101
1/6 74ACT14
C13112
C13201
IR13201
IR Remote Dector
R174
R173
Note:
-PIO1(0&1) are the same pin
PIO1
I2C
PIO1(0) / I2C MTSR
PIO1(1) / I2C MRST
PIO1(2) / I2C Clk
PIO1(3) / Capture 1
PIO1(4) / Capture 2
PIO1(5) / ASC1TxD
PIO1(6) / ASC1RxD
PIO1(7) / ASC3TxD
To under the STi5500
Relief
To Digital 1
Rx2
Gnd
10K
R29103
R29101
R29104
IR19101
Home Network?
1/6 U29101
74ACT14
-5V
Note:
PIO2(2) does not exist
PIO2(1&2) are the same pin
PIO2
PIO2(0&1)
PIO2(3)
PIO2(4)
PIO2(5)
PIO2(7)
Chrom Enable
To Video
To Modulator
To Modulator
L28105
L28106
1/6 U29101, 74ACT14
UHF remote in?
From Modulator
U13101
MT48LC1M16A1
Video SDRAM
(1M x 16)
NC 33 & 37
+5.0V
7,13,38,44
1,25
VddQ
Vdd
VssD
Vss
4,10,41,47
26,50
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
/WE
/RAS
/CSA
/CS
LDQM
CKE
CLK
UDQM
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
Audio / Video Ram
/SDCS0
/SDCS1
/SDRAS
/SDCAS
SDWE
MemClkIn (CKE)
MemClkOut (Clk)
DqmI (Ldqm)
DqmU (Udqm)
/Rst
+3.3V
11K
10K
1K
NC?
U23511
Power Supervisor?
Unkown IC Marked:
957D
021
To Digital 1
Front panel
To Digital 1
/SRst

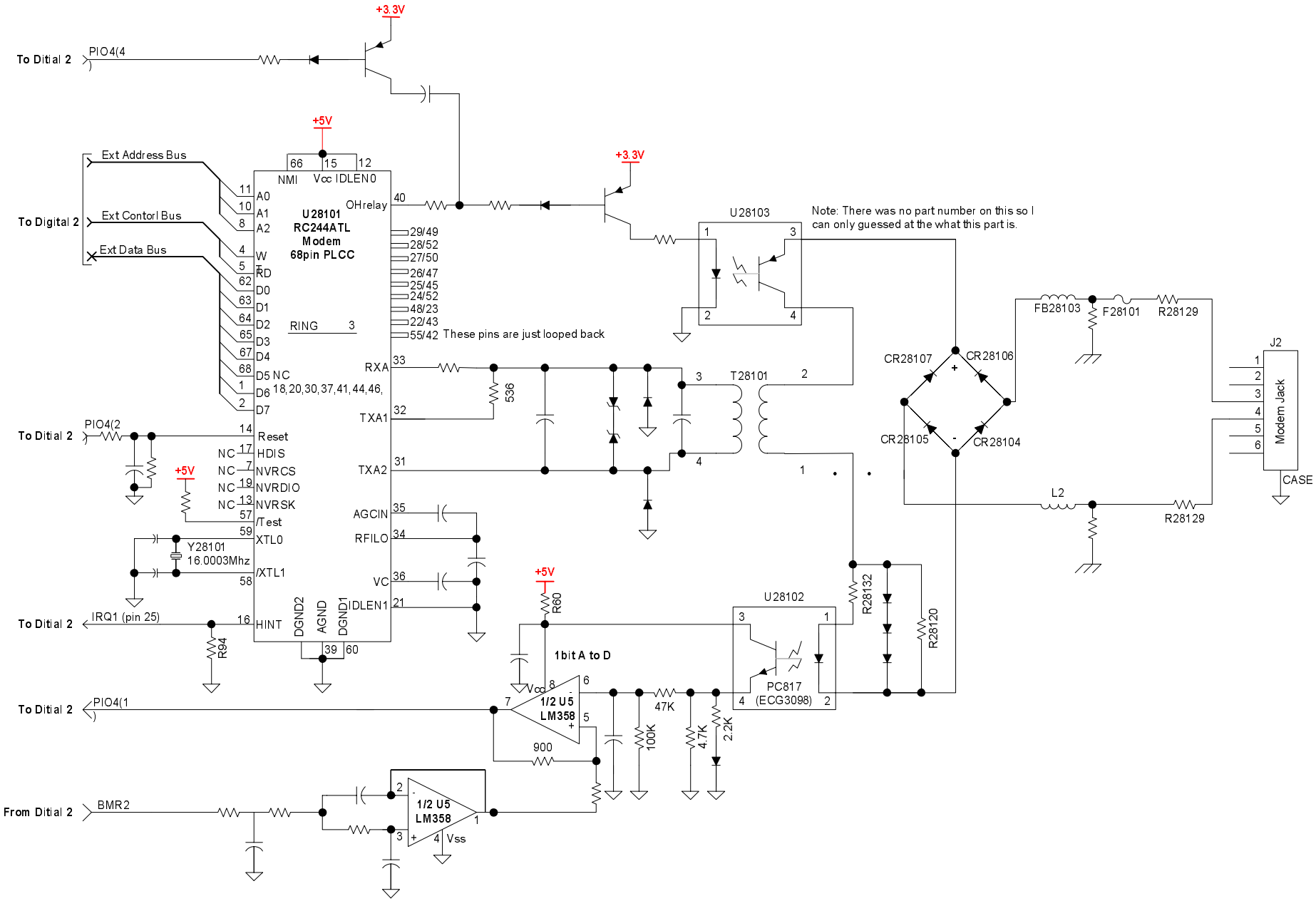


Note:
There are small value resistors between 680ohm to 1K that sit between the STi5500 and the address / data / control bus on which the memory sits. Rather than place them on the bus itself I've just placed there resistor label behind the STi5500 pin. In most cases these resistors have a P/N in the form of RN23*** or have no label at all.

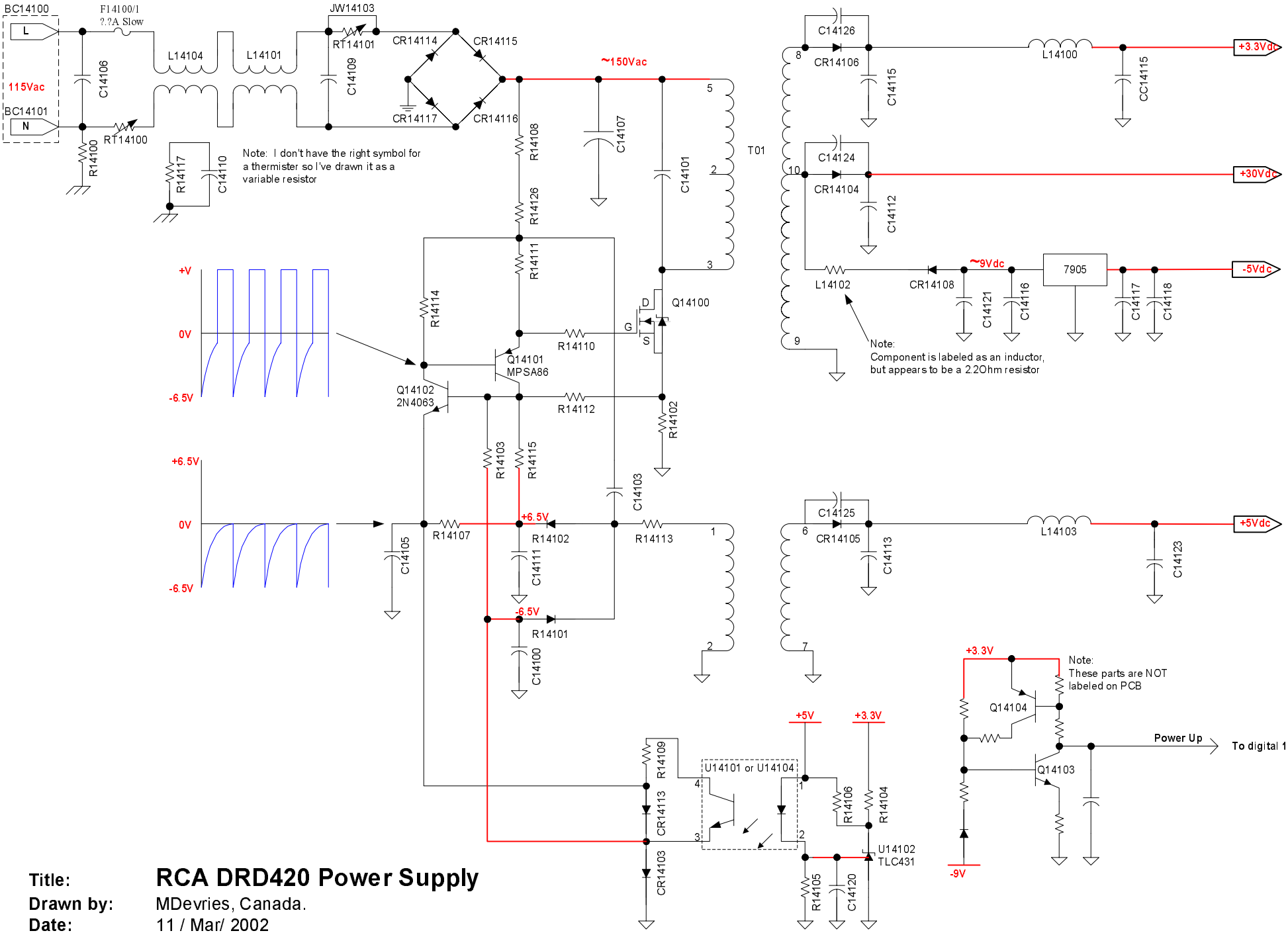
Title: RCA DRD 420 Digital
Drawn by: MDevries, Canada.
Date: 28 / Mar / 2002
PCB ID: 22910018356189, (PCB ID could easily be wrong)



Title: **RCA DRD420 LNB Power**
Drawn by: MDevries, Canada.
Date: 28 / Mar / 2002
PCB ID: 22910018356189?, PCB ID could easily be wrong



Title: **RCA DRD420 Modem**
Drawn by: MDevries, Canada.
Date: 25 / Mar / 2002
PCB ID: 229100183561897, PCB ID could easily be wrong

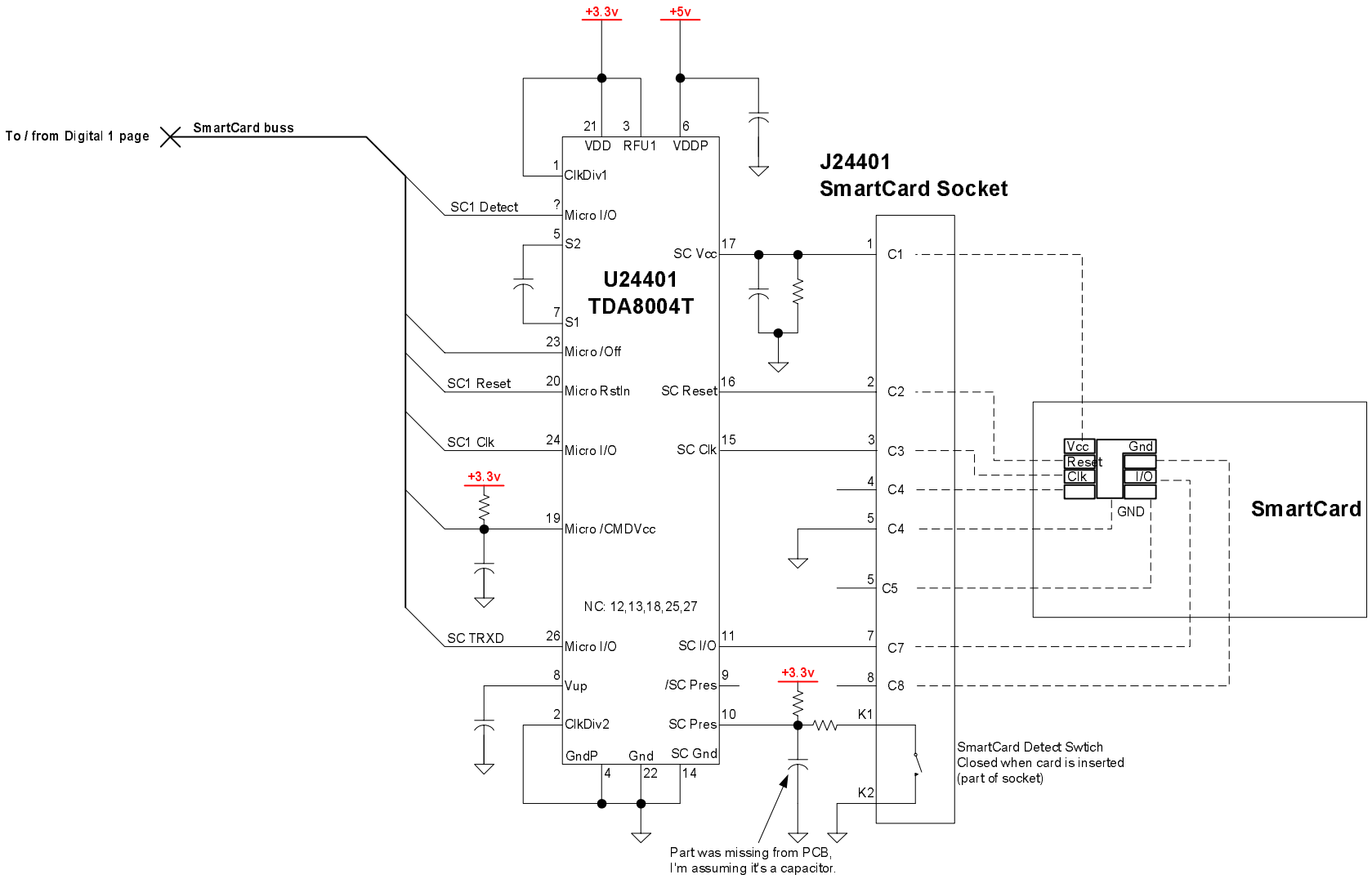


Title: **RCA DRD420 Power Supply**

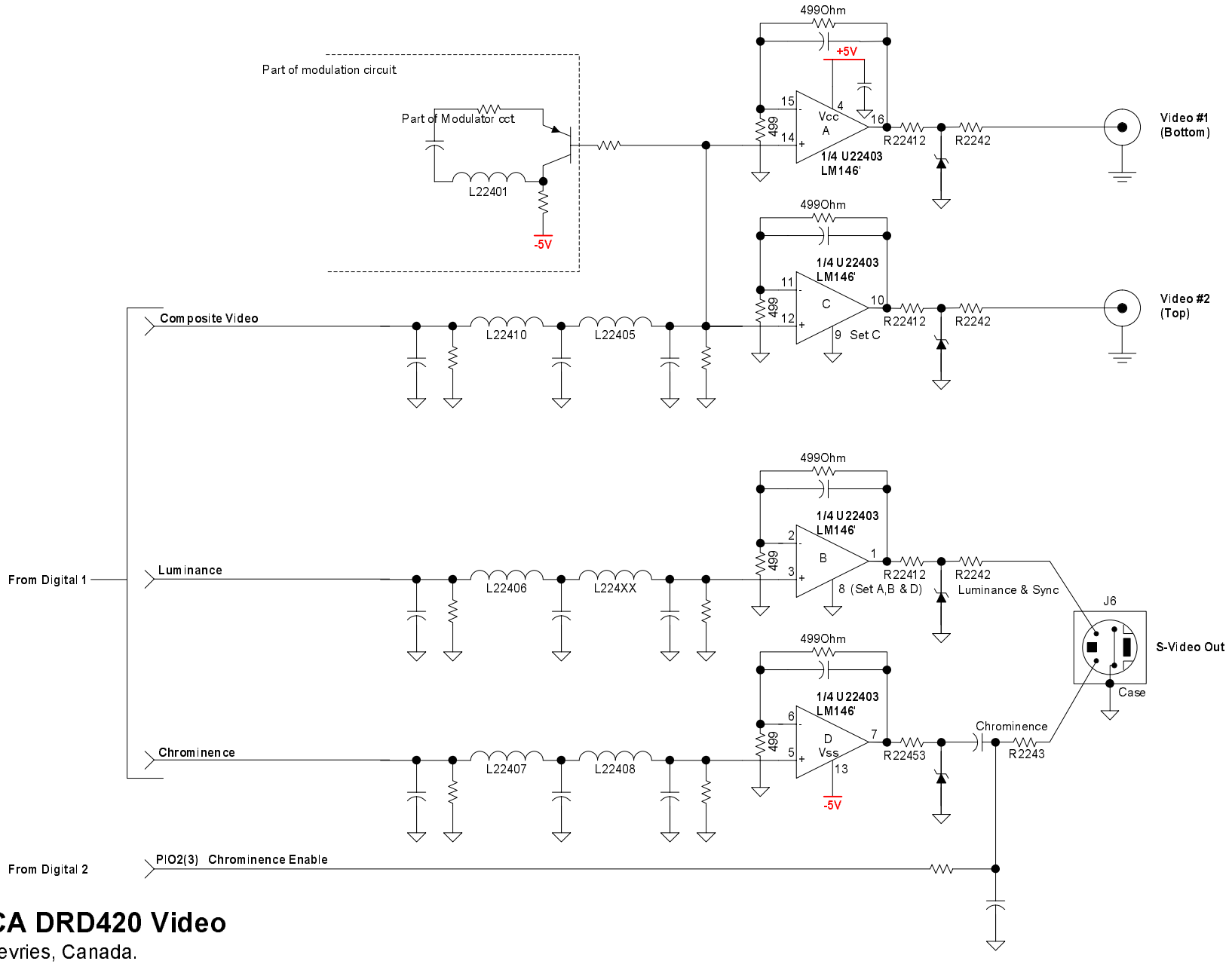
Drawn by: MDevries, Canada.

Date: 11 / Mar/ 2002

PCB ID: 22910018356189, note this ID could be wrong.



Title: **RCA DRD420 SmartCard**
Drawn by: MDevries, Canada.
Date: 18 / Mar/ 2002
PCB ID: 22910018356189 (this could be wrong)



Title: **RCA DRD420 Video**
Drawn by: MDevries, Canada.
Date: 18 / Mar / 2002
PCB ID: 22910018356189?, PCB ID could easily be wrong
Comment: With only in house marking on the Video Op Amp I can only guess at the p/n. Therefore while the LM146 fits both pin out and functionality, I cannot promise that this the correct p/n, there are other 16 pin quad op amps that might be better suited.